

## Sectional Meetings

Details of technical meetings follow. See map for building locations. Business meetings are scheduled for each section. An important item of business is the election of officers.

### A. ZOOLOGY

#### MORNING SESSION

1 KAUKÉ HALL

F. LEE ST. JOHN, PRESIDING

EFFECTS OF CALCIUM MODULATING DRUGS ON INSECT CENTRAL NERVOUS TISSUE. Kevin M. Hoffman & George F. Shambaugh, Department of Entomology, Ohio Agricultural Research & Development Center, Wooster, OHIO 44691

9:00

Drugs which modulate the movements of calcium ions into or within cells were perfused over the desheathed, last abdominal ganglion of the cockroach, Nauphoeta cinerea (Olivier). Synaptic transmission, endogenous spike activity, summed post-synaptic potentials and ganglionic polarization were measured. Sodium nitroprusside in low concentrations caused repetitive firing of giant interneurons after faradic stimulation.

CONNECTIONS BETWEEN THE NUCLEUS BASALIS AND THE ARCHISTRIATUM IN THE MALLARD.

Patrick Work, Department of Biological Sciences, Kent State University, Kent, Ohio 44242.

9:15

Research reported here is part of a study of the feeding mechanism of the mallard duck (Anas platyrhynchos) which is being conducted at the University of Leiden in the Netherlands. It was done through a Kent State University-Leiden University student exchange program in the summer of 1980. The research consisted of a neuroanatomical and histochemical investigation of the relationship between the forebrain nuclei basalis and archistriatum anterior. These are believed to be important elements in neural control of the feeding mechanism in the duck. Anatomical connections between these nuclei were studied with the aid of horseradish peroxidase injected into the archistriatum anterior nucleus. Peroxidase-labeled cells were found only in the most medial portions of the nucleus basalis from the level of the posterior commissure to the rostral border of the archistriatum anterior. Peroxidase-labeled axons were found in the lamina medullaris dorsalis (LMD) projecting from the dorsal part of the archistriatum anterior through the LMD and thence, dorsomedially, toward the labeled cells in the nucleus basalis. These findings are interpreted as indications of a functional neural connection between the nucleus basalis and the nucleus archistriatum anterior.

SPECIES-AREA EFFECT ON WINTER BIRDS OF FOREST HABITAT ISLANDS. Jeffrey L. Jefferson. Dep't of Biological Sciences, B.G.S.U., Bowling Green, Ohio 43403.

9:30

The nature of the species-area relationship outside the summer (breeding season) has been little investigated. Avian censuses were conducted in 16 oak-hickory woodlots ranging from 0.5h to 15.4h in the winter of 1979-1980 in north-west Ohio. Bird species diversity increased with increasing area and was best linearized by a log species versus log area regression analysis model. The distance of a woodlot island to its nearest species source had no significant effect on the species diversity of the island, although the distances involved may have been too small. Small woodlot islands had about the same number of species as same-sized interior forest areas; smaller islands may be depauperate due to greater exposure to winter weather. Most carnivorous bird species were found only in the larger woodlots; they showed a minimum woodlot size requirement to a greater extent than bird species of other food preferences. Overall, there is much resemblance between winter forest habitat islands and non-winter habitat islands of other studies.

A SYMPTIOTIC RELATIONSHIP BETWEEN AN AFRICAN DUNG BEETLE AND A PREDACEOUS WASP.  
Department of Biological Sciences, Bowling Green State University, Bowling  
Green, Ohio 43403.

9:45

A new example of nonobligatory mutualism (protocooperation) is described. A ball rolling dung beetle, Kheper lamarcki (Coleoptera: Scarabaeidae), provided an optimal foraging perch for a predaceous wasp, Oxybelus lepturus (Hymenoptera: Sphecidae). The predator inhibited potential prey, dung breeding Diptera, from ovipositing in the dung used by the beetle. The Diptera were unable to compete for breeding space with the beetle. Therefore, both beetle and wasp benefited from this relationship.

VOCAL REPERTOIRE IN OHIO BARN OWLS, TYTO ALBA, E. Bruce McLean, Dept. of Biology, John Carroll University, University Heights, OH 44118, and Bruce A. Colvin, Center for Environmental Research and Services, Bowling Green State University, Bowling Green, OH 43403.

10:00

Barn owl vocal behavior was studied during spring and summer, 1980, in a research project supported by the Ohio Biological Survey. More than 1275 vocalizations were archived on 60 cuts of recording tape from 5 families of owls at the Killbuck Wildlife Area in Holmes/Wayne Co., and 141 more from two other groups in northeastern Ohio. This material was edited from over 2500 recorded calls. Behavioral context of all calls was noted, and additional observations were made of unrecorded vocalizations. Three types of calls were identified from adults, some with multiple identifiable variations. These were conversational calls (often mislabeled as "hunting cries"), alarm shrieks, and rapid squeaking. Six types of calls were recorded from nestlings. These were rasping, alarm-rasping, hissing, bill-snapping, trilling, and squealing. Variations during maturation in the development of calls were noted. Playbacks of adult vocalizations at nest areas, in hunting and roosting areas, and from other locations produced few responses. No true territorial calls were identified, and there is evidence that the birds are only weakly or non-territorial. Playback appears to have little promise as a census technique. Additional work is needed, and should be concentrated on the early stages of pairing and nesting.

10:15 A.M.

SYMPOSIUM: "INVERTEBRATES IN THE CLASSROOM"

CO-SPONSORED BY SECTION A, ZOOLOGY AND SECTION H, SCIENCE EDUCATION.

SEE SCIENCE EDUCATION FOR ABSTRACTS.

## A. ZOOLOGY

FIRST AFTERNOON SESSION

101 KAUKA HALL

F. LEE ST. JOHN, PRESIDING

1:30 P.M. Business Meeting

CRAYFISHES OF THE OHIO BRUSH CREEK DRAINAGE, SOUTHCENTRAL OHIO. Michael F. Flynn and H.H. Hobbs III, Department of Biology, Wittenberg University, Springfield, OH 45501.

2:00

The Ohio Brush Creek basin drains an area of 1127 km<sup>2</sup> (435 mi<sup>2</sup>) in southcentral Ohio where it comprises parts of Adams, Brown, Highland, Pike, and Ross Counties. A total of 87 stations were sampled over a six-month period (June - November, 1980) to determine occurrence and patterns of distribution of crayfishes within the watershed. The crayfish fauna is represented by the following: Cambarus (Cambarus) bartonii (Fabricius), C. (C.) ortmanni Williamson, C. (Lacunicambarus) diogenes diogenes Girard, Orconectes rusticus (Girard), and O. sanborni sanborni (Faxon). C. (L.) d. diogenes, a primary burrower, was collected throughout the drainage. C. (C.) ortmanni inhabits burrows in the western half of the basin, and occurs with much less frequency than C. (L.) d. diogenes. C. (C.) bartonii occurs with high frequency throughout the drainage, primarily as a stream-dweller but often burrowing into stream banks and low areas. Rhoades (1962) reported O. s. sanborni to be the only species of Orconectes within this drainage except for a small area to the north inhabited by O. rusticus. Subsequent investigation, however, has revealed nearly the reverse distribution. O. rusticus currently is the most widely distributed stream-dweller, occurring in all but the extreme southern and north-

eastern ends. In these areas O. s. sanborni occurs in headwaters, O. rusticus in the trunk streams. A similar distribution of these species is observed in adjacent drainages. Apparently, extreme displacement of O. s. sanborni by O. rusticus has occurred over a relatively short period of time. Further investigation is in progress to define the mechanisms for displacement.

BIOLOGY OF THE LEGUME ROOT-NODULE FLIES (DIPTERA: PLATYSTOMATIDAE).

B. A. Foote, Department of Biological Sciences, Kent State University, Kent, OH 44242.

2:15

The biology of root-nodule flies belonging to the genus Rivellia was investigated in northeastern Ohio during 1979-80. Adults emerge in late May and early June, engage in courtship and mating on host plants belonging to the family Leguminosae, and oviposit on the soil surface during June. Larvae attack and destroy root nodules formed by species of the nitrogen-fixing bacterial genus Rhizobium. Probably two generations a year are produced in northern Ohio. Overwintering occurs as nearly mature but diapausing larvae in soil near the roots of the host plant, with pupation occurring in May.

Species of legumes serving as host plants in northern Ohio include Amphicarpa bracteata (L.) Fernald (Hog-peanut), Apios americana Medicus (Ground-nut), Desmodium spp. (Tick-trefoil), and Robinia pseudo-acacia L. (Black Locust).

The potential economic significance of larval damage to the nitrogen-fixing nodules of legumes will be discussed. A southern species has recently shifted to soybeans from a native legume. With some 30 North American species of Rivellia, the possibility of additional shifts to introduced legumes of agricultural significance (e.g. alfalfa, clovers, peanut) is considerable. Other workers have reported that up to 65% of the root nodules of certain tropical legumes have been destroyed by Rivellia larvae.

OSMOREGULATION IN PALMONAETES PUGIO David P. Duell and Jerry H. Hubschman. Dept. of Biological Sciences, Wright State University, Dayton, Ohio 45435

2:30

The objective was to measure and evaluate the ATP-dependent carrier molecule in osmoregulation of the grass shrimp, Palaemonetes pugio, under varying salinities. The range of experimental salinities was from 0% to 300% (100% = 35‰). Exposure time was 48 hours, after which the gills were excised and placed in an incubation medium containing tris-maleate buffer and lead nitrate. Following fixation, black insoluble lead sulfide granules deposited at sites of ATPase activity were counted using phase contrast microscopy. Cell organelle variation was studied using electron microscopy.

Results to this date, show granular deposition to be evenly distributed throughout the cell and in close association with the nuclei at 100% salinity. When we changed the salinity in either direction away from 100%, the granules became concentrated along the plasmalemma. At salinities below 100%, there was a decrease in granular density, suggesting a decrease in the number of ions moved to maintain its normal osmolarity. At salinities greater than 100%, there was an increase in granular density, suggesting an increase in the number of ions moved to maintain its normal osmolarity. Changes in granular concentration would suggest alteration of cellular function reflecting shifts in osmoregulation.

SPERMIOGENESIS IN A FRESHWATER GASTROTRICH, LEPIDODERMELLA SQUAMMATA. Margaret R. Hummon, Dept. Zool. and Microbiol., Ohio University, Athens, Ohio 45701.

2:45

Until 1978, freshwater gastrotrichs were thought to be obligate parthenogens. There is now evidence from 2 labs for sperm in L. squammata, based on TEM (1978, Ohio J. Sci. 78:11) and Feulgen (1979, Science 205:302-303), and life history information (Levy, 1980, Am. Zool. 20[4]). This report describes several stages in the formation of sperm in living, known aged individuals, using Nomarski optics and photomicrography. Isolated animals of various ages and reproductive history were removed from individual culture for study at 625-2500X (n=73); 23 were returned to culture and later re-examined, 2-6 times each. A typical animal lays 4 eggs at 1-1½ day intervals, days 2-6. Spermiogenesis did not occur in actively reproducing animals (n=19) or just after the last egg was laid (n=18). One of four sequential stages of spermiogenesis was observed in all healthy post-reproductive animals examined (n=44), and more than one stage in 7. L. squammata is thus a protogynous hermaphrodite. All stages were located in the abdomen just posterior to the protonephridial mass, on one or both sides; two stages may occur simultaneously. STAGES: 1. Four cells enclosed by membrane (last egg + 1½ days; n=1). 2. Numerous scattered elongate bodies, faintly discernible, enclosed by a membrane (+½-2½d; n=7). 3. Condensed easily visible rods (sperm) lying parallel in a bundle, adjacent to a spherical dense mass within a common membrane (+1-5d; n=10). Some with an enlarging 5th egg (n=2) or a posterior bilobed structure (X-organ?) (n=4). 4. Sperm as in 3, but dense mass and membrane lacking (+2-20d; n=22). Enlarging 5th egg (n=11) or X-organ (n=8) may be present; 5th egg, if present, was not laid. Stage 4 also observed in some animals laying 1, 2, or 3 eggs (+3-24d, n=8).

AN INVESTIGATION ON THE LARVAL HABITAT OF FIVE TREE-HOLE BREEDING MOSQUITOES. Lee Mitchell, Toledo Area Sanitary District, 5015 Stickney Ave., Toledo, Ohio 43612 and C. Lee Rockett, Dept. of Biological Sciences, Bowling Green State Univ., Bowling Green, Oh. 43403

3:00

Ninety-eight tree holes with mosquito larvae were studied at three locations in the vicinity of Bowling Green, Wood County, Ohio. The majority of tree species were oaks (Quercus spp.) 57%, hickories (Carya spp.) 30% and red maples (Acer rubrum) 7%. Larval collections (27,741 specimens) were comprised of Aedes triseriatus (90.8%), Orthopodomyia signifera (3.3%), Aedes hendersoni (3.2%), Anopheles barberi (2.7%) and Orthopodomyia alba (<.1%). Chemical parameters (BOD, tannin-lignin, pH and conductivity) were similar for different trees and the selection of a particular tree species by any of the tree-hole mosquitoes was not noted. Present evidence would indicate that interspecific competition was lessened somewhat by niche segregation. Examples of morphological, physiological and behavioral differences between species were found and it was recognized that these are important factors in determining niche occupancy. Ecological differences were noted in three niche dimensions: trophic, spatial and temporal.

CADDISFLIES OF OHIO (INSECTA: TRICHOPTERA). Alex Huryn, Department of Biological Sciences, Kent State University, Kent, OH 44242.

3:15

Prior to 1970, with the exception of Marshall's (1939) study of western Lake Erie, little work dealing exclusively with the Trichoptera of Ohio had been published. Since 1970 eight surveys of Ohio Trichoptera have been initiated. These have resulted in six publications that present distributional records for 196 caddisfly species.

Most of these recent studies have involved areas of glaciated northeastern Ohio. A survey is presently underway in southeastern Ohio dealing with the Trichoptera of the Little Muskingum River drainage in Monroe County. A marked similarity between the northeastern and southeastern Ohio caddisfly faunas is indicated. The western and southwestern Ohio Trichoptera, in contrast, have been poorly studied, and knowledge of the caddisfly fauna of these latter areas is still largely based upon records from Ross' (1944) work on the Illinois fauna.

INTRA-CAVE DISTRIBUTION OF COLEOPTERA IN A MAJOR MYOTIS SODALIS HIBERNACULUM. David Bruce Conn and Gerald L. DeMoss. Dept. of Biological and Environmental Sciences, Morehead State University, Morehead, KY 40351.

3:30

Bat Cave, one of the world's largest hibernacula for the endangered Indiana Bat (Myotis sodalis), is developed in a small section of Mississippian limestone in northeastern Kentucky.

During the winter of 1979-1980, cavernicolous beetles in Bat Cave were studied to determine their intra-cave distributional patterns. Each of nine study stations was described with regard to substrate type and degree of organic material deposition from bat activity and/or stream flooding. Stations were monitored approximately once per week for temperature and relative humidity. Beetles were collected by pitfall trapping, Berlese extraction and visual survey.

Among 26 beetle taxa collected, four were abundant in the cave. All four were associated primarily with bat guano deposits in the cave's upper level or in the main hibernation room. Aglenus brunneus (Colydiidae) and Prionochea opaca (Leptodiridae) were restricted to a single room. Atheta sp. and Aleochara sp. (Staphylinidae) occurred throughout the cave, but exhibited niche separation between each other.

With regard to the data obtained, it is suggested that bat guano deposits are more important than stream-deposited detritus in determining intra-cave distributional patterns for troglophilic (facultatively cavernicolous) beetles inhabiting Bat Cave. Abiotic factors monitored did not appear to influence distribution. Further studies are needed for verification of these suggestions.

3:45

Barn owl (Tyto alba) pellets were periodically collected from 5 sites during 1979. A total of 5,332 prey items were identified. Mammal prey was evaluated as a percentage of total prey and as percent biomass of total mammal prey. Of 18 species of mammals taken, meadow vole (Microtus pennsylvanicus) was the number one prey item by number (63.18%) and by biomass (71.06%). Other common prey by number were short-tailed shrew (Blarina brevicauda) (21.16%) meadow jumping mouse (Zapus hudsonius) (5.03%), Peromyscus spp. (4.26%) and Norway rat (Rattus norvegicus) (1.05%). Birds were 1.33% of the total prey. Less common or unusual prey were house mouse (Mus musculus), shrews (Sorex cinereus and Cryptotis parva), big brown bat (Eptesicus fuscus), moles (Condylura cristata, Parascalops breweri, and Scalopus aquaticus), eastern chipmunk (Tamias striatus), muskrat (Ondatra zibethica), and striped skunk (Mephitis mephitis). Seasonal differences in prey were found only in the jumping mouse, which hibernates, and moles, which were taken principally from May through July and were probably dispersing juveniles. Norway rats taken averaged 63.4 grams, which reflects selection for smaller rats. All sites were linked to wetlands, grass, or hayfield habitats.

## A. ZOOLOGY

### SECOND AFTERNOON SESSION

1 KAUKÉ HALL

DAVID H. STANSBERY, PRESIDING

1:30 P.M. Business Meeting in 101 Kauke Hall

MONOGENETIC TREMATODES OF OHIO CATOSTOMID FISHES. John C. Mergo Jr. and Dr. Andrew White, Department of Zoology, The Ohio State University, Columbus, Ohio, and The Department of Biology, John Carroll University, Cleveland, Ohio.

2:00

Four new species of monogenetic trematodes, representing Pseudomurraytrema, Pellucidhaptor, and Dactylogyrus, are described from the gills of suckers. Three new host records and ten Ohio records are reported. The host records established are Neodiscocotyle carpioditis from Ictiobus bubalus and Dactylogyrus hamatus and Pseudomurraytrema etowanum both from Hypentelium nigricans. The new Ohio records Pseudomurraytrema paradoxum, Dactylogyrus apos, and Dactylogyrus ursus from catostomids collected in the Grand River, Ashtabula-Lake County border; Pseudomurraytrema etowanum, Pseudomurraytrema rogersi, and Dactylogyrus hamatus from Silver Creek, Geauga County; Dactylogyrus duquesnei and Anonchhaptor anomalum from Salt Creek, Pickaway County; Neodiscocotyle carpioditis from Lake Erie at Lorain County; and Pseudomurraytrema alabarrum from Bridge Creek, Geauga County.

GROWTH AND MORTALITY STUDIES OF LARVAL GIZZARD SHAD (Dorosoma cepedianum LeSueur) FROM MAUMEE BAY, WESTERN LAKE ERIE. Theresa C. Gordon, C. Lawrence Cooper and Charles E. Herdendorf. Center for Lake Erie Area Research, The Ohio State University, Columbus, Ohio 43210.

2:15

Between April 15 and September 3 of 1975 and 1976, surface and bottom collections of larval gizzard shad were made at eight sampling locations in a 122 sq km area of Maumee Bay. Samples were taken with a 0.75 m diameter oceanographic plankton net (0.760 mm mesh) equipped with a General Oceanics flowmeter. Using the method of Hackney and Webb (1978, Fourth National Workshop for Entrainment and Impingement, EA Communications, Melville, NY), mortality rates of 2.73 ( $r^2 = 0.80$ ) and .85 ( $r^2 = .91$ ), and growth rates of .20 ( $r^2 = .85$ ) and .23 ( $r^2 = .91$ ) were computed for the 1975 and 1976 seasons, respectively. Mortality is expressed in units of larvae per 100  $m^3$  per day and growth is expressed in units of mm per day. The results are discussed in light of the critical period hypothesis which attributes a portion of mortality to starvation during transition from yolk sac to active feeding.

A PRELIMINARY ANALYSIS OF DIET AND RESOURCE PARTITIONING IN ETHEOSTOMA CAERULEUM STORER AND ETHEOSTOMA FLABELLARE RAFINESQUE IN ROCK RUN, CLARK COUNTY, OHIO. Valentine, D.W., and C.A. Stewart. Department of Biology, Wittenberg University, Springfield, OH 45501.

2:30

Etheostoma caeruleum Storer and Etheostoma flabellare Rafinesque occur together in riffle areas of Rock Run, Clark County, Ohio. The diets of these two percids were studied by gut analysis during fall 1980. Hydropsyche larvae, Cheumatopsyche larvae, Stenelmis larvae, and chironomid larvae are the predominant benthic macroinvertebrates in Rock Run. Hydropsyche larvae, chironomid larvae, and Cheumatopsyche larvae (arranged in order of decreasing importance) were the three most important components of the diet of E. caeruleum, while Stenelmis larvae, chironomid larvae, and Hydropsyche larvae (in order of decreasing importance) were the three most important components of the diet of E. flabellare. Diet overlap (Morista 1959) between the two darters was high,  $\hat{C}_h = 0.94$ . However, Stenelmis larvae were significantly ( $p < 0.05$ ) more important in the diet of E. flabellare than in the diet of E. caeruleum. Likewise, Hydropsyche larvae made up a significantly ( $p < 0.05$ ) larger proportion of the diet of E. caeruleum than E. flabellare. Diet diversity (MacArthur 1972) was lower for E. flabellare than E. caeruleum, 4.4 as compared to 5.25. It is suggested that diet overlap between E. caeruleum and E. flabellare may decrease as food availability decreases, a possibility now being investigated.

GROWTH AND MORTALITY STUDIES OF LARVAL YELLOW PERCH (Perca flavescens) FROM THE LOCUST POINT AREA OF WESTERN LAKE ERIE. D. L. Breier, T. C. Gordon, C. Lawrence Cooper and Charles E. Herdendorf. Center for Lake Erie Area Research, The Ohio State University, 484 West 12th Avenue, Columbus, Ohio 43210.

2:45

Growth and mortality rates of larval yellow perch (Perca flavescens) were calculated from samples collected near Locust Point in the western basin of Lake Erie. Samples were collected from 5 stations both day and night from April 13 to September 1 at 7-10 day intervals. A 0.75 meter diameter oceanographic plankton net with 550 micron mesh was used; the net was also fit with a flowmeter to measure volumes of water filtered. Calculations were made using the methods developed by Hackney and Webb (1978, Fourth National Workshop on Entrainment and Impingement, EA Communications, Melville, NY) for the growth and mortality of larval fish populations. In essence these calculations were made by plotting densities versus length over time. From this we derive the growth and mortality of the larval perch. This method is potentially a very useful management tool in the understanding of fish population dynamics of large bodies of water such as Lake Erie.

FEEDING MECHANISM IN ASTRONATUS OCELLATUS (OSCAR): A CINEMATOGRAPHIC AND PARAFFIN MOLD ANALYSIS. Hiran M. Dutta and Lisa Lowery. Department of Biological Sciences, Kent State University, Kent, Ohio 44242.

3:00

The Astronatus ocellatus (Oscar), a cichlid fish which originates from the upper Amazon basin of Brazil, is a slow feeder. The feeding mechanism of this fish has been recorded by a cinematographic technique (64 frames per sec.). A paraffin mold technique (Grobecker et al., 1979) was used to record the total buccal cavity expansion and the displacement of the internal buccal elements. The feeding mechanism has been subdivided into two phases, food intake and the accommodation of the food in the buccal cavity. The paraffin mold technique shows a 122% volume increase of the buccal cavity while fully expanded and the gape of the mouth was 10.2 cm<sup>2</sup>. Cinematography shows that this cichlid fish has a slow feeding mechanism (54 sec. per phase) compared to other teleosts. The premaxilla and maxilla undergo protrusion twice in one phase. The depression of the lower jaw is conducted by the hyoid apparatus, which is followed by the upper jaw protrusion. As in most teleosts Astronatus ocellatus engulfs its prey by creation of a negative pressure in the buccal cavity resulting from its rapid expansion. A causal relationship exists between the continued buccal expansion and the ventral movement of the hyoid apparatus.

MONTHLY TRENDS IN NEARSHORE WATER QUALITY FOR WESTERN LAKE ERIE. Audrey A. Rush and Charles E. Herdendorf. Center for Lake Erie Area Research, The Ohio State University, Columbus, Ohio 43210.

3:15

Locust Point was selected as a representative station for western Lake Erie near-shore water quality. Samples were collected monthly during the ice-free period of the year from 1974 to 1980. Samples were analyzed for 18 parameters, 8 of which included nitrate, silica, sulfate, calcium, chloride, conductivity, turbidity and suspended solids will be discussed. Concentration of non-conservative (nutrients), conservative (major dissolved ions) and suspended parameters were compared to determine seasonal and long term trends. Maximum concentrations of most parameters occurred in the early spring and late fall with minimum concentrations during mid-summer. Long term trends remained reasonably stable indicating no apparent increase or decrease in Lake Erie water quality.

A REVISION OF THE DISTRIBUTION OF THE ENDANGERED FISH SPECIES, ETHEOSTOMA EXILE (IOWA DARTER), IN OHIO. George Phinney, Dept. of Life Science, Otterbein College, Westerville, Ohio 43081. Daniel L. Rice, Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Fountain Square, Columbus, Ohio 43224.

3:30

The Iowa Darter (Etheostoma exile), a glacial relic species in Ohio, was once thought to be nearing extirpation from Ohio waters due to habitat destruction. As a result of the recent discovery of Iowa Darters in a few inland glacial lakes by independent researchers, an intensive survey of the glacial lakes in Ohio was undertaken by the authors in the fall of 1980 as part of the Division of Natural Areas and Preserves' inventory of endangered species. To date, we have identified 14 new populations from glacial lakes in 6 counties, bringing the currently known distribution to 19 populations in 8 counties. Lakes having populations of Iowa Darters are characterized by having relatively clear water and areas of firm bottom with submersed aquatic vegetation. Darters were most often found along shorelines in association with Potamogeton, Myriophyllum, Chara or other submersed aquatics in waters ranging from a few inches to two feet in depth. Iowa Darters were absent from those lakes having bottoms composed entirely of soft organic matter or which lacked beds of submersed aquatics. Eutrophication, both natural and accelerated, and other impacts resulting from man's activities have reduced the amount of favorable habitat present in many lakes, and may eventually lead to the elimination of some darter populations.

INTRODUCTION AND SPREAD OF NATIVE AND NON-NATIVE FISHES INTO OHIO WATERS  
Ted M. Cavender, Museum of Zoology, The Ohio State University, Columbus 43210

3:45

Data are presented to show that the introduction of fish species into areas of the state where they were not formerly found has increased at an alarming rate over the last decade. Most introductions are directly or indirectly the result of the operations of several commercial industries in Ohio such as the bait fish industry, the aquarium industry, and the sport fishing industry (state and other stocking programs).

An example of a recently introduced non-native species is the red shiner, Notropis lutrensis, which has been widely sold as an aquarium fish in Ohio. The red shiner has been collected at three different localities in northern Ohio and may already have become established in one drainage.

# B. PLANT SCIENCES

FIRST MORNING SESSION

101 KAUKU HALL

A TREE SURVEY OF THE COLLEGE OF WOOSTER CAMPUS. Oliver D. Diller. 1368 E. Wayne Ave. Wooster, Ohio 44691

8:30

This is one of the most attractive college campuses in America. The College of Wooster was founded in 1866 on a hill covered with a timber stand of virgin white, red and black oaks and other associated species found in this forest type. Many of the original trees are still in good condition but during the past century a number of exotic species have been introduced as landscape material.

In August, 1979 a 100 percent census of the trees on the campus was initiated. Purpose was to collect information on the number, size, and condition of all the tree species and cultivars present. The campus was subdivided into five major areas and the trees were listed by species and diameter at 4½ feet above ground. Observations were made on each tree as to whether or not it was in good health, declining, or dead, and recommendations made as to treatment, if any. This information is being used by the Administration and the Grounds Superintendent in planning for campus maintenance and tree planting programs.

IN SUPPORT OF ELIZA SULLIVANT AS THE DISCOVERER OF SULLIVANTIA SULLIVANTII. Charles C. King, Ohio Biological Survey, 484 W. 12th Ave. Columbus, Ohio 43210.

8:45

Sullivantia sullivantii, as indicated by the original describers of the species (Torrey and Gray, 1838-1840), was named for William Starling Sullivant, whom they recognized as the original discoverer of the species. Katherine D. Sharp (1913) indicated that "It was the wife [Eliza Griscom Wheeler Sullivant] of William Sullivant, the noted Ohio botanist, who first found the flower which is known as the Saxifrage Sullivantia, and brought it to his attention." This undocumented reference has been unknown to or ignored by the authors of the commonly available manuals (Fernald, 1950; Gleason, 1952) which make no reference to Mrs. Sullivant. Recently, Andrew D. Rodgers, III of Columbus, Ohio, showed me a formal mount of the species dated 1840 which documents Mrs. Sullivant as the original discoverer of the species.

DISTRIBUTION OF THE HEART-LEAF PLANTAIN, PLANTAGO CORDATA LAMARCK, IN PLUM RUN, ADAMS COUNTY, OHIO. Patricia D. Jones and Anne R. Filbert, Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Fountain Square, Columbus, OH 43224

9:00

Historical records for the Heart-leaf Plantain, Plantago cordata, document its occurrence in at least ten Ohio counties. Today, the known Ohio distribution is restricted to one locality, Plum Run, a small alkaline stream in Adams County. Because of the rarity of P. cordata, a study was initiated to determine the size and distribution of the Plum Run population.

In the spring of 1980, 3674 plants were scattered along a 1.2 km section of Plum Run. An estimated 75-85% were flowering specimens. 68.9% of the total grew on the banks and in the stream channel, 9.9% were on the flood plain, and 21.2% were located in minor tributaries. Plants bloomed from mid-April to mid-May. By the beginning of June most seeds had ripened and dispersed. The first seedlings were observed on June 21. Results of severe summer floods were evident during subsequent visits to the area. The number of seedlings was greatly depleted while mature plants with extensive root systems appeared to tolerate the increased current and bottom scouring which must have occurred. The dolomite substrate, reliable water supply, and shaded stream bed of Plum Run favor the continued existence of P. cordata. Changing land use and pollution appear to be major threats to this species.



DISTRIBUTIONAL STATUS OF SOME PREVIOUSLY PRESUMED RARE OHIO PLANTS. David M. Spooner, Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Fountain Square, Columbus, Ohio 43224.

9:15

The Ohio Natural Heritage Program designates 685 species of native Ohio plants as endangered, threatened, potentially threatened or presumed extirpated, based largely upon the number of natural populations in the state. Recent field work has significantly altered the known rarity of many of the listed species. The Ohio status and distributions of Heuchera parviflora Bartl. var. rugelii (Schuttlw.) Rosend., Butt. & Lak., Heuchera villosa Michx. var. intermedia Rosend., Butt. & Lak., Eupatorium incarnatum Walt., and Penstemon canescens Britt. were studied over the last two years. In Ohio, these species can be locally common in the proper habitats, but are on the edges of their ranges in the state and are apparently confined to the extreme southeastern portion.

THE FLORA OF PORTAGE, STARK, SUMMIT AND WAYNE COUNTIES, OHIO. Barbara K. Andreas. Ohio Natural Heritage Program, ODNR, Fountain Square, Columbus, Ohio 43224, and Cuyahoga Community College, Warrensville Twp., Ohio 44122.

9:30

An inventory of the extant as well as the historic vascular flora of Portage, Stark, Summit and Wayne Counties, Ohio, was prepared. The flora, based on more than 20,000 plant specimens, was constructed from a 4-year field survey, a survey of Ohio herbaria, and a survey of pertinent floristic literature.

The vascular plant flora of the four counties is comprised of 131 families, 597 genera and 1,615 species. Approximately 119 species are presumed extirpated from the four counties. Twenty-one of these are also presumed extirpated from Ohio.

While these four counties are among the most rapidly developing counties in Ohio, they still contain numerous natural areas. However, since the early 1900's, at least 11 botanically significant areas have been completely or partially destroyed. The remaining natural areas house an unusual assemblage of rare Ohio plants.

THE OHIO SPECIES OF PUCCOON, LITHOSPERMUM CANESCENS (MICHX.) LEHM. AND LITHOSPERMUM CROCEUM FERNALD. Allison W. Cusick, Division of Natural Areas and Preserves, Ohio Department of Natural Resources, Fountain Square, Columbus, OH 43224.

9:45

Two species of puccoon (Boraginaceae) occur in Ohio, Lithospermum canescens (Michx.) Lehm. and Lithospermum croceum Fernald. L. canescens is generally distributed throughout the eastern United States and occurs in most sections of Ohio. L. croceum is endemic to the Great Lakes and the north-central United States and adjacent Canada, and in Ohio is restricted to the northernmost tier of counties. Quality of pubescence frequently is used to separate these two species. More precise characters are calyx and corolla lengths, size of nutlets, and period of anthesis. Many manuals subsume L. croceum into L. carolinense (Walt.) MacM., a wide-ranging species of the southeastern United States. This accounts for reports of L. carolinense from Ohio. However, L. carolinense and L. croceum are nearly exclusive geographically and can be distinguished by a number of morphological characters.

OBSERVATIONS ON THE MYXOMYCETE GENUS CLASTODERMA. Harold W. Keller, Department of Microbiology and Immunology, Wright State University, Dayton, Ohio 45435; Jean D. Schoknecht, Department of Life Sciences, Indiana State University, Terre Haute, Indiana 47809; David W. Mitchell, Walton Cottage, Upper Hartfield, East Sussex, England, TN7 4AN; Kenneth D. Whitney, Department of Botany, University of North Carolina, Chapel Hill, North Carolina 27514

10:00

Clastoderma debaryanum is the only cosmopolitan species of Clastoderma, usually occurring on decaying wood found on ground sites. It was described by Blytt in 1879 and was for many years the only taxon recognized in Clastoderma. In 1929 a variety of debaryanum was described by Emoto and given the name emperatorium in honor of Emperor Hirohito, who first collected this taxon from a living Quercus acuta tree on the grounds of the Imperial Palace, Kanagawa Prefecture, Japan. Formerly only known from Japan, over 25 collections of emperatorium were gathered in four counties in Ohio on living Vitis, Fraxinus, Quercus rubra, and Liriodendron tulipifera. Study of the variety emperatorium suggests this is a distinct taxon differing from C. debaryanum in sporangial size, the shape, size, and ornamentation of peridial plates, complexity and branching patterns of the capillitium, and spore ornamentation. Clastoderma pachypus Nann.Brem., formerly known only from its type collection from France, is a widely distributed corticolous myxomycete based on 18 collections from Ohio, California, Dominica, Ireland, and England. Clastoderma microcarpum (Meyl.) Kowalski, formerly known only from its type collection from Japan, is a common corticolous myxomycete in the United States based on 28 collections from Arkansas, Kansas, Kentucky, Missouri, and Tennessee. Although closely related, C. pachypus and C. microcarpum are distinct species differing in sporangial size, stalk color, and features of the capillitium. Supported by a grant to HWK from the Ohio Biological Survey.

10:15

The conventional format for taxonomic treatments in revisionary studies has been used now for over a century. The types of information usually included are: generic and specific descriptions and synonymy; keys to included taxa; distribution maps; representative specimens; and discussions of relationships or other problems. Although this format has served well, present need for greater clarity of data for phenetic and cladistic analyses suggests that some changes be introduced. It is recommended that the specific descriptions be replaced by a descriptive basic data matrix and that keys be overlain on this matrix by appropriate symbols. The former forces a much clearer presentation of characters and states and the data become completely comparative for any phenetic or cladistic study. The latter forces emphasis on the basic data matrix and allows multiple entry for comparison of taxa. As an example of their utility, these recommendations are employed in a revision of Desmanthodium (Compositae, Heliantheae).

10:30 BUSINESS MEETING

## B. PLANT SCIENCES

SECOND MORNING SESSION

102 KAUKA HALL

BUMBLEBEE POLLINATION RELATIONSHIPS ON THE BEARTOOTH PLATEAU TUNDRA OF SOUTHERN MONTANA. Paul J. Bauer. Department of Biology, The University of Akron, Akron, Ohio, 44325.

8:45

The coadaptive, dynamic relationship between the members of a floral community and their respective bumblebee pollinators was studied on the alpine-tundra of the Beartooth Plateau in southern Montana. A total of 42 man-hours was spent collecting 284 bumblebees (Bombus Latr.) foraging for pollen and/or nectar on Castilleja pulchella, Delphinium bicolor, Gentiana romanzovii, Lupinus monticola, Mertensia ciliata, Oxytropis campestris, Penstemon procerus, and Trifolium parryi. The number of Bombus species per plant species ranged from 1 to 8. Pollinator fidelity was assessed by analysis of corbicular pollen loads. Monolectic foragers comprised 42.6% and polylectic foragers 57.4% of those bumblebees with pollen loads. Correlation of bumblebee tongue lengths with floral tube lengths did not indicate specific resource partitioning. Nontundra nesting bumblebees from lower elevations preferred typically nontundra plants, i.e., those plants protected by krummholz or abandoned mining excavations. Examination of perianth colors in visible light by reflectance spectrophotometry and in long-wave (360 nm) ultraviolet light by photography disclosed well-defined visible light reflectance spectra but ultraviolet reflectance only in Delphinium bicolor. Insect enclosure studies indicated all species except Penstemon procerus highly reliant on bumblebee pollinators. Bumblebee and floral anthesis phenologies, plant stature correlates, and cinematographic records of foragers were also examined.

THE POLLINATION ECOLOGY OF PEDICULARIS IN MONTANA - PRELIMINARY REPORT. Lazarus Walter Macior, Department of Biology, The University of Akron, Akron, Ohio 44325.

9:00

A study of the pollination ecology of Pedicularis cystopteridifolia and P. groenlandica on the Beartooth Plateau Tundra of Montana revealed that these species are obligately dependent upon bumblebees (Bombus Latr.) as pollen vectors to which they are structurally and phenologically adapted. Pollinated by queen and worker bumblebees, the nectariferous P. cystopteridifolia is preceded in bloom by the nectariferous P. oederi and followed by the nectarless worker-pollinated P. groenlandica. Corolla tube dimensions of nectariferous species generally correspond to proboscis lengths of castes and species of nectar-foraging pollinators. Pollen-foraging bumblebees show a limited degree of floral fidelity as determined by microscopic analysis of corbicular pollen loads. A collection of 500 Bombus pollinators on Pedicularis and Mertensia ciliata in the same area indicated that workers (389) are more frequent than males (81) or queens (30). Greater frequencies on plant species of certain of the 9 Bombus species in the study area were related to altitudinal and habitat adaptations of these insects. A second season of field study should corroborate preliminary findings suggesting that coadaptive integration of plant species and their pollinators may involve reproductive resource sharing as a fundamental adaptive function. On the arctic-alpine tundra it is unlikely that resource partitioning and competition for forage or pollinator service are major factors in this coadaptation.

9:15

Three woodland sites were selected for collecting data on Galeorchis spectabilis in the spring of 1979 and 1980 in northeastern Ohio. A total of 82 hours were spent at two of these sites which were chosen for observing the foraging of Bombus queens on spring ephemerals. The effect of 5 additional plant species in attracting bumblebees in relation to G. spectabilis pollination was also studied. These plant species included Aesculus glabra, Dicentra canadensis, Geranium maculatum, Iris pseudacorus, and Pedicularis canadensis. Of the 123 bumblebees captured 74% foraged on flowers and 26% hunted nesting sites. Bombus vagans, the most abundant species, comprised 49.6% of the total bumblebee fauna and was the only observed pollinator of G. spectabilis. Pollen gatherers constituted 7% of the bees captured.

Caging experiments on G. spectabilis indicated 4% self compatibility, 100% outcrossing fertility, and a required animal pollen vector. In the two populations of G. spectabilis studied 17-21% of the plants flowered, while fruit production in these ranged between 0% and 11%. Seed production measured by two different methods averaged 3485 seeds/fruit and 6656 seeds/fruit, respectively. Both methods indicated more than adequate seed set to replace the existing populations even if only one fruit/season were produced.

BIOLOGICAL NITROGEN INFLUX IN AN OHIO RELIC PRAIRIE. John D. DuBois and Lawrence A. Kapustka, Dept. of Botany, Miami Univ., Oxford, OH 45056.

9:30

The objectives of the study were (1) to monitor fluctuations of terrestrial Nostoc sp. populations, (2) to determine the annual input of biologically fixed N, and (3) to relate the effects of environmental parameters on Nostoc sp. populations and N<sub>2</sub>-fixation activity on the Lynx Prairie Preserve, Adams Co., Ohio.

Sampling was performed during 15 site visits beginning 29 Mar. through 8 Nov., 1980. The percent cover of Nostoc sp. colonies was measured using point-frame analysis. Nitrogen fixation activity was measured using the acetylene-reduction technique. Precipitation, soil and air temperatures, and soil water potentials also were measured.

Dramatic fluctuations in Nostoc sp. cover were attributed to major changes in temperatures and/or soil water potentials. The Nostoc sp. colonies contributed almost all of the biologically fixed N at the site until late June. Following this period, heterotrophic diazotrophs played an important part along with Nostoc sp. in the N<sub>2</sub>-fixation activity. Extrapolation of measured rates show Nostoc sp. contributing  $4.60 \pm 1.17 \text{ Kg ha}^{-1} \text{ yr}^{-1}$  and the heterotrophic diazotrophs contributing an additional  $3.19 \pm 1.18 \text{ Kg N ha}^{-1}$  annually. Legume and actinorhizal species at the site occur at such low numbers we consider their N contribution to be negligible. These rates of Nostoc sp. and heterotrophic diazotroph N<sub>2</sub>-fixation are among the highest values reported for temperate grassland habitats.

THE VEGETATIONAL AND MICROBIAL RESPONSE TO FIRE IN THE LYNX PRAIRIE PRESERVE, ADAMS COUNTY, OHIO. Anne Annala and Larry Kapustka, Botany Department, Miami University, Oxford, Ohio 45056.

9:45

The use of fire to manage and maintain the relic prairies of Ohio, especially those on the shallow soils in Adams County has been questioned. These prairies are in jeopardy due to the rapid encroachment of forest species. This study, conducted on the Annette's Prairie of the Lynx Prairie Preserve, was initiated to determine the efficacy of fire management for this area. A controlled burn (25 m<sup>2</sup>) was accomplished on 3 May 1980. The burned area and an adjacent control plot were monitored biweekly through 8 November 1980.

The vegetation in the burned plot compared to the control plot emerged earlier and was more vigorous throughout the summer. In addition, in the burned plot flowering culms emerged some 2 weeks earlier and there were more flowering culms per plant. There were no apparent detrimental effects on either grass or forb species as a result of the fire.

Microbial activity, monitored via measures of selected residual soil enzymes, varied from one date to the next. However, no significant differences between burn and control plots were detected. Additional measures of selected soil nutrients are being performed. At present, no detectable effect on soil fertility or microbial activity has been registered.

These results are consistent with reports of fire response in other prairies. They indicate there is nothing fundamentally different with respect to fire response in the Adams County prairies. It is our conclusion that spring burning is an appropriate, effective tool which can be employed not only to preserve, but also to improve the condition of these prairies.

NITROGEN NUTRITION IN AN INLAND SALT MARSH. David Gray Loveland. Department of Botany, Ohio University, Athens, Ohio 45701

10:00

The influence of nitrogen nutrition on productivity (biomass) and nitrogen composition in three species of halophytes, Salicornia europea, Atriplex triangularis, and Hordeum jubatum, was analyzed throughout the growing season in an Ohio salt marsh.

A set of randomized plots was established in each zone along the salinity gradient, each plot was treated at the beginning of the growing season with a single pulse of nitrogen ( $\text{NH}_4\text{NO}_3$  or  $\text{KNO}_3$ ) or left untreated (control). Soil and plant material (shoots, roots and flowers) which was collected throughout the growing season was analyzed for total nitrogen. Data was analyzed by statistical methods to determine relationships between plant biomass, nitrogen content and available soil nitrogen and soil salinity.

ACETYLENE REDUCTION ( $\text{N}_2$  FIXATION) BY ALNUS RUGOSA (DUROI) SPRENGEL AND THE ALLELOCHEMIC EFFECTS OF POPULUS TREMULOIDES (MICHX.) IN THE NORTHERN HARDWOOD FOREST.

Patricia D. Younger, and Lawrence A. Kapustka, Department of Botany, Miami University, Oxford, Ohio 45056.

10:15

Alnus rugosa (DuRoi) Springel, speckled alder, is an actinorhizal diazotroph occurring from Newfoundland to British Columbia and south to Ohio. Often it occurs as the principle subcanopy species in aspen (Populus tremuloides (Michx.)) dominated forests. Aspen has been shown to have an allelochemic effect upon microorganisms, mycorrhizal fungi and selected herbaceous species. The objective of this study was to characterize the  $\text{N}_2$  fixation rate of alder and to determine the possible allelochemic influence of aspen on alder.  $\text{N}_2$  fixation was determined by one hour assays using the acetylene reduction technique. Intact nodules of alder shrubs were assayed from 29 May, 1980 to 12 August, 1980. These data were collected from pure alder stands and alder-aspen mixed stands in northern Wisconsin.  $\text{N}_2$  fixation rates in the pure stand increased from a rate of  $24.55 \mu\text{g N/g nodule dry weight/hour}$  ( $\mu\text{g N/g dwt/hr}$ ) on 12 June to a maximum of  $73.89 \mu\text{g N/g dwt/hr}$  on 26 June. This rate declined to  $9.20 \mu\text{g N/g dwt/hr}$  by 12 August. In the mixed stand the rate declined from  $22.12 \mu\text{g N/g dwt/hr}$  on 12 June to a low of  $3.56 \mu\text{g N/g dwt/hr}$  on 24 July. During the latter half of the summer the  $\text{N}_2$  fixation rate in mixed stands increased to its maximum of  $28.57 \mu\text{g N/g dwt/hr}$ . These data show alder as a major source of N for the northern hardwood community. Extrapolating this measured rate for the entire sample period shows a 56.4% decrease in  $\text{N}_2$  fixation/activity by alder when it occurs with aspen. These data support the interference hypothesis.

10:30 BUSINESS MEETING 101 KAUKU HALL

## B. PLANT SCIENCES

THIRD MORNING SESSION

105 KAUKU HALL

ASPARAGINE SYNTHESIS IN SOYBEAN ROOT NODULES. Thomas A. Huber and John G. Streeter. Department of Agronomy, OARDC, Wooster, Ohio, 44691.

8:30

Soybean (Glycine max (L.) Merr.) root nodules export asparagine as the principal amino acid in the phloem of  $\text{N}_2$ -fixing plants. The synthesis of asparagine by the ATP and glutamine dependent amidation of aspartic acid has been demonstrated by *in vivo* radioactive labeling and the isolation and partial purification of the enzyme asparagine synthetase (E.C. 6.3.5.4). Experiments utilizing detached nodules indicate that dark fixation of ( $^{14}\text{C}$ )  $\text{CO}_2$  results in radioactive label in aspartic acid and asparagine. Vacuum infiltration of the nodules with methionine sulfoximine or azaserine, inhibitors of glutamine synthetase and glutamine amide transfer reactions respectively, resulted in much lower levels of label in asparagine.

Asparagine synthetase was isolated from nodules of plants 40-70 days old. High sulfhydryl protection was required and the inclusion of substrates in the extraction buffer helped to stabilize the enzyme. The enzyme was partially purified using ammonium sulfate precipitation and Sephadex G-25 column chromatography. The partially purified enzyme preparation had an apparent  $K_m$  of 0.84 mM for aspartic acid. Glutamine and ATP were shown to be required for asparagine formation.

EFFECT OF ETHYLENE ON PEA EPICOTYL TISSUE I. TIMING OF ETHYLENE-INDUCED PEA EPI-  
COTYL SWELLING AND ITS MODIFICATION BY CALCIUM AND OTHER GROWTH INHIBITORS.  
Ann DiFrancesco, Donald R. Rayl and Grant M. Barkley, Department of Biological  
Sciences, Kent State University, 4314 Mahoning Avenue, N.W., Warren, Ohio 44483

8:45

Application of ethylene gas to four or five-day-old etiolated pea seedlings (Pisum sativum L. cv. Alaska or Patriot) results in a rapid decrease in elongation growth and an increase in radial expansion (swelling) of subapical internode tissue. Timing measurements indicate that the decrease in elongation growth and the increase in radial dimension is concentration dependent, and may occur as rapidly as 15-20 minutes after exposure to 100 ppm ethylene or within 1.5 hours at concentrations of 10 ppm. Kinetics of radial expansion, induced by ethylene, show typical 'sigmoid' curves with the linear phase lasting for 10-12 hours.

Long term measurements of growth inhibition and swelling are indexed using the ratio of length to weight (millimeters/milligrams) in a marked 10 mm subapical zone. Using the index ethylene removal experiments indicate very little recovery from tissue fully induced. Tissue grown in calcium or lanthanum tend to resist the increase in radial expansion induced by ethylene. The effect of EDTA is to amplify the ethylene induced swelling response.

THE EFFECT OF CITRIC ACID ON THE POLARITY OF THE MOSS, ATRICUM UNDULATUM L.,  
CHLORONEMA GROWTH. Moosik Kwon and C. Creutz, Department of Biology, The University  
of Toledo, Toledo, Ohio 43606.

9:00

Unilateral white light (9 watts/m<sup>2</sup>) induces the polarized growth of moss chloronema. The growth direction is dependent upon the direction of irradiation. However, citric acid strongly inhibits the light-induced orientation of chloronemal growth. The degree of inhibition is dependent upon the amount of citric acid added to the medium. In addition, the very tip of the chloronema burst at 5 mM citric acid within 10 mins. At the concentration of 2.5 mM citric acid, the distal 2 or 3 microns of the tip portion swells, and the chloroplasts (originally distributed more or less evenly in the tip cell) clump either in the middle of the cell, or near the cross cell wall. The results of PAS staining indicate that PAS-positive substances were presumably accumulated in the tip portion, originally occupied by the chloroplasts. The transfer of the swelled chloronema to the medium without citric acid initiates many chloronemal branches in the first, and second cells (at the proximal side to the light). This indicates that citric acid hampers the polarity of chloronemal growth. The plausible relationship of citric acid and growth direction of moss chloronema will be discussed.

PURIFICATION AND PROPERTIES OF AN EXONUCLEASE (PHOSPHODIESTERASE I)  
FROM GLYCINE MAX. Arfaan A. Rampersaud and Richard E. Jagger, Jr.  
Defiance College, Defiance, Ohio, 43512.

9:15

Phosphodiesterase I has been purified over 2,000 fold from Glycine max seeds with recoveries averaging 10 percent. Because of considerable pH and heat stability of the enzyme in the crude extract, the exonuclease was prepared by a procedure involving a change in pH, from 8.4 to 5.0, coupled with a 60°C heat step. Following ammonium sulfate fractionation, the enzyme was further purified by chromatography on Sephadex G-100, Blue Dextran-Sepharose 4B, and DEAE cellulose. The molecular weight of the enzyme was estimated to be 85,000 using SDS gel electrophoresis.

Using the p-nitrophenyl ester of thymidine-5'-phosphate as substrate, the purified enzyme exhibited a pH optimum between 8.7 and 8.9. The K<sub>m</sub> of the enzyme with respect to p-nitrophenyl-5'-TMP was determined to be 30.8 micromolar. Divalent cations (Co<sup>++</sup>, Ca<sup>++</sup>, Cd<sup>++</sup>, Zn<sup>++</sup>) enhanced enzymatic activity, while Hg<sup>++</sup> and EDTA were strongly inhibitory. Reducing agents depressed enzymatic activity.

While the enzyme hydrolyzed synthetic p-nitrophenyl esters of both ribo- and deoxy-ribonucleotides, the deoxy esters were hydrolyzed faster than the ribo esters. End products of the reaction, the 5'-nucleotides, inhibited activity, particularly 5'-AMP and 5'-dAMP.

9:30

Purified chloroplast DNA (cpDNA) has been successfully isolated from *Lupinus texensis* plants using a relatively rapid technique. The technique differs from previously reported techniques in that high speed centrifugation of cpDNA in cesium chloride gradients can be omitted for restriction fragment analysis. Specific restriction endonucleases are used to cleave cpDNA at specific sites, resulting in fragments which can be fractionated by electrophoresis.

Differences in the nucleotide sequence of cpDNA between individuals can be identified if these differences occur within the nucleotide sites that an endonuclease recognizes. This technique will be applied to population studies of *Lupinus texensis* and *L. subcarneus*. It will allow us to evaluate genetic variability within and between populations, directly at the DNA level. This will provide information about gene flow, population subdivision, and levels of polymorphism. The results will be compared with data from concurrent studies of nuclear genes.

#### EFFECTS OF SIMULATED ACID RAIN ON CULTIVATED TOMATOES

Elaine D. Keithan

Department of Biology, Bowling Green State University  
Bowling Green, Ohio 43403

9:45

Tomatoe plants were treated with simulated acid rain for a period of one month on a twice a week basis. The experiment was performed on tomatoe plants (*Lycopersicon*) of cultivar H722 to determine the effects of simulated acid rain on visible leaf surface injury and fruit yield.

Field grown tomatoe plants were exposed to simulated acid rain at pH levels 5.5, 3.0, 2.5 and 2.0. At harvest, tomatoes were divided into categories of red, green, and rots, then counted and weighed for a comparison of yield.

Results show that, in comparison to control plants, the yield in terms of numbers of fruits was not effected by treatment, however yield in terms of weight decreased significantly. The total weight yield per treatment decreased with a decrease in pH. At pH below 2.5, red fruit weight yield was lowest while the weight yield of rotting fruits increased.

OZONE INJURY IN YOUNG LEAVES OF HYBRID POPLAR IN RELATION TO PEROXIDASE ACTIVITY.  
Roy L. Patton\*# and Michael O. Garraway#. \*USDA Forest Service, P. O. Box 365, Delaware, OH 43015 and \*#Department of Plant Pathology, The Ohio State University, Columbus, OH 43210.

10:00

The effect of ozone ( $O_3$ ) levels on the activity of peroxidase in leaves from hybrid poplar clone NE-50 (*P. maximowiczii* Henry x *P. berolinensis* Dipp) were studied in relation to  $O_3$ -induced injury. Objectives were to determine the level of  $O_3$  necessary to elicit a peroxidase response, whether peroxidase activity increased with length of exposure to  $O_3$ , and the temporal relationship between an increase in peroxidase activity and development of visible symptoms. Rooted cuttings in three-gallon plastic pots containing a 2:1 soil-sand potting mixture were placed in open-topped field chambers. Ozone at concentrations of 0, .05, .10, and .15 ppm was added to the carbon filtered air entering the chambers through blowers. One leaf from each of three plants in each chamber was harvested every two weeks over a six week period. Leaves were inspected for  $O_3$  injury at the time of harvest then were lyophilized and stored at -20C until analysis for peroxidase activity. The activity of peroxidase extracted with 0.01 M phosphate buffer, pH 6, was determined spectrophotometrically with  $H_2O_2$  and guaiacol as substrates. The  $\Delta O.D. \text{ min.}^{-1} \text{ g.}^{-1}$  of tissue was determined at 470 nm. The results indicate that  $O_3$  causes an increase in peroxidase activity and that the onset of the increase precedes overt injury. The sequence of peroxidase increase and visible expression of injury induced by  $O_3$  suggest an underlying cause and effect relationship.

THE EFFECTS OF SODIUM CHLORIDE ON THE MORPHOLOGY AND LEAF ANATOMY OF ATRIPLEX TRIANGULARIS. Willa S. Ewing. Department of Botany, Ohio University, Athens, Ohio 45701.

10:15

Experiments were set up to determine the character of the morphological and anatomical responses of the halophyte, Atriplex triangularis, to sodium chloride treatments. Seedlings of Atriplex were grown to maturity in Hoagland's nutrient solution containing 0, 0.5, 1 or 2 percent sodium chloride in a growth chamber.

Salinity is shown to affect the size of plants, branch development, leaf number, seed production and overall leaf anatomy. Plant height decreased at the 1 and 2% sodium chloride levels, while branch development and leaf number was greatest in 0.5 and 1% sodium chloride. Changes in leaf anatomy included an increase in leaf thickness due to an increase in cell size of various tissues and the disappearance of druses with increased salinity.

10:30 BUSINESS MEETING 101 KAUKU HALL

## B. PLANT SCIENCES

FOURTH MORNING SESSION

125 KAUKU HALL

EFFECT OF ROW WIDTH ON SPRAY PENETRATION INTO THE ROW AND SPUR BLIGHT INCIDENCE OF 'HERITAGE' RED RASPBERRIES. M. A. Ellis, R. N. Williams, and H. R. Krueger, Departments of Plant Pathology and Entomology, Ohio Agricultural Research and Development Center, Wooster, OH 44691.

8:45

Spur blight of red raspberry is caused by the fungus Didymella applanata. The disease is becoming a serious problem in Ohio, especially on the variety 'Heritage'. The purpose of this study was to evaluate the effect of row width on spray penetration into the row and incidence of spur blight. Rows of 'Heritage' red raspberry were trained to either 18, 36, or 54 inches wide in a randomized block design with three replications. Measurements on spray penetration into the row were made by mounting microscope slides on aluminum poles and placing the poles in the center of the row so that slides were parallel to the row. Permethrin (Ambush 2E) was applied at the rate of 2 lb a.i. per acre using a Mity Mist air blast sprayer at a pressure of 300 psi and tractor speed of 2 miles per hour. Slides were collected after spraying and washed with acetone into glass jars. Acetone solutions were then standardized and analyzed for the presence of permethrin by gas chromatography. Incidence of spur blight was evaluated by measuring the length of cankered area on 100 canes per replication at the end of the growing season. Mean canker length significantly increased with each increase in row width. Spray deposition in the row centers significantly decreased with each increase in row width. The results of this study indicate that maintaining row width is an important cultural practice that needs to be considered in the development of disease control recommendations for red raspberry.

INFLUENCE OF PODOSPHAERA LEUCOTRICHA ON PHYSIOLOGY OF APPLE LEAVES. M. A. Ellis and D. C. Ferree, Departments of Plant Pathology and Horticulture, respectively, Ohio Agricultural Research and Development Center, Wooster, OH 44691.

9:00

Powdery mildew infection significantly reduced photosynthesis and transpiration of apple leaves. Inhibition was more severe on leaves infected during early stages of development than for mature, fully expanded leaves. Percentage leaf area covered by mycelia for mature leaves exceeded percentage reduction of photosynthesis and transpiration. Nine days after inoculation, leaf area covered by mycelia was 20% for mature leaves, with no reduction in photosynthesis or transpiration. At 30 days after inoculation, 90% of the leaf was covered and percentage reduction of photosynthesis and transpiration was 54 and 46%, respectively. Young leaves (infected as they emerged from the bud) were 90% covered by mycelia when they were 11 days old and their mean rate of photosynthesis and transpiration was reduced 85 and 55%, respectively. Infected young leaves were severely distorted; mature leaves appeared normal, except for mycelia. Where reductions in photosynthesis and transpiration were observed, there was a corresponding reduction of leaf carbohydrate content. Infected leaves did not recover from inhibition of photosynthesis and transpiration after treatment with fungicide and removal of surface mycelia.

THE OVERWINTER SURVIVAL OF COLLETOTRICHUM GRAMINICOLA ON CORN RESIDUE AND ITS SIGNIFICANCE AS A SOURCE OF INOCULUM FOR ANTHRACNOSE STALK ROT. Patrick E. Lipps. Department of Plant Pathology, Ohio Agricultural Research and Development Center, Wooster, OH 44691.

9:15

Within the last decade, Anthracnose has become an important disease of corn in the major corn growing areas of the U. S. Little is known about the ability of C. graminicola to survive overwinter on infested crop residues or about the different sources of inoculum which possibly initiate infection. Infested corn residues were collected in early spring 1980 from commercial fields that had been plowed the previous fall. Residues left on the soil surface and those buried 4 to 15 cm below the soil surface were collected from six different locations. Colletotrichum graminicola produced acervuli and viable spores on 27% more of the corn stalks that overwintered on the soil surface than those that were buried. The number of acervuli that developed on the soil surface residues was also much greater than those that were buried. The effect of different sources of inoculum (i.e. buried infested oat kernel for root inoculation and spore suspensions sprayed on the base of the stalk for stalk inoculations) were tested on the susceptible hybrid B73XMo17. Root inoculation did not increase the incidence or severity of stalk rot, yet grain yield per ear was significantly reduced. Stalk inoculation increased the incidence and severity of stalk rot and significantly reduced yield. This study indicates that tillage systems which leave infested corn residues on the soil surface have a greater potential for loss from Anthracnose stalk rot.

MOTILITY OF A PLANT PATHOGENIC BACTERIUM NEAR THE HYPHAE OF FUNGI. Curt Leben. Dept. of Plant Pathology, Ohio Agricultural Research and Development Center and The Ohio State University, Wooster, OH 44691.

9:30

Cells of Pseudomonas lachrymans, a motile pathogen of cucumber plants, were seeded in a narrow ring, 2 cm in diameter, in the center of petri plates containing water agar agar, 1.5 g liter). Fungi were seeded in a 2-3 mm<sup>2</sup> area in the center of the ring. Plates were sealed with "Parafilm M" and incubated at 24C. The hyphae of Pythium ultimum (a fast-growing, plant pathogenic fungus found in soil) grew on the agar surface through the P. lachrymans cells in the ring and extended to the plate rim. Movement of bacteria from the ring was determined by observing the agar surface at 1,000X (40X objective, 25X ocular) and by replica printing the surface with a velvet pad onto an agar medium that permitted the growth of P. lachrymans but not the fungus. Prints demonstrated that the bacterium moved from the ring to all parts of the plate (there was no movement unless the fungus was present). Bacteria were observed swimming in the narrow strip of water next to young hyphae; near old hyphae the strip usually was entirely occupied by stationary bacterial cells. With plates seeded with a Rhizopus sp., P. lachrymans moved only from the ring toward the plate center, even though hyphae had reached the plate rim. This was because hyphae grew to the ring and then down through the agar under the ring before they surfaced and reached the rim. Motility near hyphae probably is widespread in nature.

METHOD FOR DETERMINING WOOD DECAY IN CONTROLLED GASEOUS ENVIRONMENTS. T. J. Hall and Curt Leben. Dept. of Plant Pathology, Ohio Agricultural Research and Development Center and The Ohio State University, Wooster, OH 44691.

9:45

The effects of oxygen concentration on wood decay incited by Polyporus compactus (Pc) Overh. were studied in a controlled atmosphere. Paired wood blocks (WB) (2 x 2 x 0.5 cm) composed of sapwood and heartwood of similar radial position and age were cut from frozen red oak branch disks. Each pair consisted of a fresh block (stored at -20 C since collection) and dried block (72 C for 4 da). Initial dry weight estimates of fresh blocks were based on weight of dried blocks in each pair. Dry WB were rehydrated and frozen at -20 C. Each frozen WB was surface sterilized by immersing in boiling water for 6 sec. Forty WB pairs were inoculated with wood feeder strips colonized by Pc. Individual WB were placed in vented plastic petri dishes (15 x 60 mm) with a moist pad to maintain wood moisture levels. Dishes with WB were placed in vertical racks (10 dishes/rack). Two racks were inserted into each of five airtight jars. Jars were attached to a manifold through which a hydrated mixture of prepurified N<sub>2</sub> and purified air was delivered at 10 psi at a constant flow rate (12.3 L/jar/day). WB were incubated for 10 wks at 24 C and continuous light. Ten WB pairs were non-inoculated controls. At 21% O<sub>2</sub>, mycelium growth was dense. In single trials, dry weight loss in fresh and dried blocks inoculated with Pc each average 27%, whereas losses in controls were 7% and 0.5%, respectively. At lower O<sub>2</sub> levels, less mycelium growth and lower dry weight losses were recorded. The method is useful for determining amount of wood decay as compared with standard methods because volatile staling by-products are removed, fresh wood can be used, and soil is not used.



MICROSCOPIC EVALUATION OF MICROBIAL DEGRADATION OF INTACT FORAGE PLANT TISSUE.  
K. E. McClure. Animal Science Department, Ohio Agricultural Research and Development Center, Wooster, Ohio 44691.

10:00

Microscopic studies of intact forage plant tissue subjected to in vitro degradation were conducted on a 41-day regrowth of limpgrass (Hemarthria altissima, PI299995), a tropical grass. Transverse pieces (3-9 mm long) from each of eight leaf blades and counterpart stem internodes, plus internode pieces (3-9 mm long) cut in half longitudinally, (all from one plant), were fermented 48 hr with bovine rumen microorganisms. Freezing microtome sections (12  $\mu$ m thick) from adjacent unfermented and fermented pieces were mounted for before and after fermentation observations. Three staining techniques (Iodine-potassium iodide-sulfuric acid, phloroglucinol, lignin-pink) plus polarizing and ultra-violet light microscopy were used to compare degradation of cell wall components of various tissues within the plant. There was little apparent difference in degradation of leaf blade tissues from top to bottom of the plant. However, cell walls in phloem were more completely degraded in upper than lower leaf blades. In stem internodes from the upper half of the plant, parenchyma cell walls were completely degraded whereas they were incompletely degraded in the lower internodes. Parenchyma cell walls of internodes cut in half longitudinally were degraded more completely than those in transverse pieces. During fermentation vascular bundles were digested free from ground tissue in upper but not in lower internodes cut longitudinally. Variability of type and location of tissues within the same plant must be considered in evaluation of degradation of forage cell walls fermented with rumen microorganisms.

MYCOGEOGRAPHIC DISTRIBUTIONS OF THE HIGHER FUNGI AS RELATED TO THE PALEOHISTORY OF THEIR SYMBIONTS. George E. Host, Department of Biological Sciences, Kent State University, Kent, Ohio 44242

10:15

The disjunct mycogeographic distributions of many of the mycorrhizal fungi are intimately related to those of their host plant symbionts. An example of this is the distribution of the boletinoid fungus Suillus pictus, mycorrhizal on haploxyton pines, which occurs in southeast Siberia and Japan, the eastern United States, and Chiapsis, Mexico, having followed the migrations of its host in the Tertiary and Pleistocene epochs. It is hypothesized that S. pictus was mycorrhizal on the ancestral form which gave rise to the Pinus strobus-Pinus monticola complex, and was apparently displaced from P. monticola by competitive exclusion in the Pacific Northwest. Tertiary climatic changes and possibly Pleistocene glaciations induced the southward migrations of some elements of the temperate flora into Central America. These are likely to be the causal factors for the migrations and subsequent establishment of P. strobus and S. pictus in the cloud forests of Chiapsis, Mexico.

10:30 BUSINESS MEETING 101 KAUKU HALL

## B. PLANT SCIENCES

FIRST AFTERNOON SESSION

102 KAUKU HALL

STRUCTURE AND RELATIONSHIPS OF SIMPLE, PERMINERALIZED MEDULLOSAN POLLEN ORGANS.  
James E. Mickel and Gar W. Rothwell. Department of Botany, Ohio University, Athens, Ohio 45701.

1:30

The discovery of radial synangia containing Monoletes prepollen provides the basis for describing a new genus of medullosan pollen organs. To date, 78 permineralized specimens from the Upper Pennsylvanian Duquesne Coal of Ohio have been examined. Each consists of four elongate sporangia connected by a central zone of sclerenchyma. Distally, the sporangia separate and the sclerenchyma is replaced by dehiscence tissue with histological features like those of Doleriotheca and Stewartiotheca. The sporangia are loosely enclosed by a parenchymatous cover with prominent contents in some cells. Among presently recognized medullosan pollen organs, the specimens are most similar to Rhetinotheca, Halletheca, Aulacotheca, and Codonotheca.

MEGAGAMETOPHYTES OF AN UPPER PENNSYLVANIAN WOODY LYCOPSID. Kathleen B. Pigg and Gar W. Rothwell. Department of Botany, Ohio University, Athens, Ohio 45701.

1:45

Well preserved cellular megagametophytes representing several developmental stages are described from the fructification of a newly recognized Upper Pennsylvanian woody lycopsid. Most of the megagametophytes occur within a bisporangiate fructification, while others are isolated in the coal-ball matrix. Megaspores are assignable to Valvisporites auritus and associated microspores conform to Endosporites. Among the developmental stages represented are immature, abortive megaspores and spore tetrads, acellular stages, and cellular gametophytes with and without archegonia. Typically, cellular gametophytes have large cells occupying the distal 2/3 of the spore and much smaller cells toward the proximal surface. Immature gametophytes are preserved entirely within the spore wall. In later developmental stages gametophyte tissue protrudes through the open trilete. There are up to five archegonia per gametophyte. Archegonia may have four tiers of neck cells, although those in later stages retain only two tiers. The discovery of these gametophytes adds to our understanding of Carboniferous lycopod reproductive biology and further characterizes one of the most completely represented coal ball plants.

AN ANALYSIS OF CAMBIAL DEVELOPMENT IN SPHENOPHYLLUM. Michael A. Cichan. Department of Botany, The Ohio State University, 1735 Neil Avenue, Columbus, OH 43210

2:00

Although a large number of fossil plants occurring in Pennsylvanian age coal balls are characterized by secondary vascular tissue, little is known about the meristematic activity responsible for the formation of this tissue. One of the principal reasons that relatively little information has been assembled for the vascular cambium is that the fragile, thin-walled cells are rarely preserved. In spite of this, developmental information about the vascular cambium can be obtained indirectly by an examination of the arrangement of tracheary elements in the secondary xylem. In this regard, the secondary xylem of Sphenophyllum was analyzed to determine the frequency and orientation of anticlinal (multiplicative) divisions of the fusiform initials. The study suggests that the vascular cambium of Sphenophyllum functioned in a manner similar to that of the secondary thickening meristem in some extant plants. It was noted, however, that enlargement of the fusiform initials plays a much greater role in circumferential growth than in living plant groups.

UPPER PENNSYLVANIAN SPHENOPTERID FOLIAGE FROM SOUTHEASTERN OHIO. Sara P. Stubblefield. Department of Botany, The Ohio State University, Columbus, Ohio 43210.

2:15

A large suite of sphenopterid foliage of varying size and morphology was recovered from Upper Pennsylvanian sediments in southeastern Ohio. Material is assigned to Sphenopteris on the basis of pinnule morphology. There is no evidence of the petiolar divisions which separate Sphenopteris from genera with similar pinnule morphology. The most complete frond fragments are triangular and consist of three orders of alternately arranged pinnae. Specimens exhibit a continuous range of variation in pinnule size, shape, and morphology, and individual pinnules of all forms are markedly decurrent giving the axis a distinctly winged appearance. All pinnules show identical venation, marginal dentation, and secretory cavities. Two of the specimens are fertile. Two - five heavily cutinized reproductive structures are clustered at the tips of ultimate segments. They are oval, approximately 0.5 mm X 1.0 mm, and are each attached to the foliage by a short stalk. In some specimens a narrow rim of tissue encircles the dense, oval central body. Reproductive structures are intact and show no evidence of dehiscence mechanism or of internal structure. Haptotypic marks are absent. This sphenopterid material cannot be assigned to an existing species. Rather, it forms an intergrading series which represents a single taxon. The reproductive structures suggest that it is pteridospermous.

2:30 THE OCCURRENCE OF STEPHANOSPERMUM (PTERIDOSPERMOPHYTA) IN THE LOWER PENNSYLVANIAN OF NORTH AMERICA. Charles W. Good, Gar W. Rothwell and Thomas N. Taylor. Department of Botany, The Ohio State University, Lima, Ohio 45804; Department of Botany, Ohio University, Athens, Ohio 45701; and Department of Botany, The Ohio State University, Columbus, Ohio 43210.

Three anatomically preserved ovules have recently been discovered in coal balls from the Lewis Creek locality in eastern Kentucky, and these provide the basis for describing a new species of Stephanospermum. The specimens are roughly urn-shaped, 1.5 cm long and 0.8 cm in maximum diameter, with an extended micropylar canal and a rounded chalaza. In transverse sections the seed cavity is round-hexagonal and the external surface is ornamented by 12 prominent ribs. The integument consists of a poorly preserved endotesta, relatively thin sclerotesta and a prominent sarcotesta of large, loosely arranged cells. Unlike other species of Stephanospermum, a sclerotestal crown is absent. The nucellus is free from the integument above the chalaza and the large pollen chamber has an extended nucellar beak. Vascular tissue consists of 12 bundles that extend toward the apex within the integumentary ribs, and a solid mantle of tracheids within the nucellus. These specimens represent the earliest known occurrence of Stephanospermum, and are clearly related to other genera of medullosan ovules.

2:45 CARPELLARY EPIDERMIS AND CHANGES ASSOCIATED WITH GYNOCIAL MATURATION IN ORNITHOGALUM CAUDATUM (LILIACEAE). Varien R. Tilton, Department of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403.

Abaxial epidermal cells of infolding carpels fuse where they touch. Not all cells touch and fuse along radial axes, resulting in formation of long narrow axial chambers (septal nectaries). Cells lining these chambers produce nectar which is exuded at anthesis. Fused cells lose their identity as epidermal cells, but most sutures can be identified. Abaxial epidermal cells have an outer wall 2-3 times thicker than other walls. It is overlain by a thick trilayered cuticle, the inner layer of which is 7-8 times thicker than the outer cuticle proper, and the epicuticular wax layer appears as a thin convoluted sheet. Anomocytic stomates develop in the abaxial epidermis following fertilization. Cells of this layer also contain lipid bodies aggregated with other organelles into cytoplasmic units known as lipotubuloids. These apparently are sites of lipid metabolism and storage. The adaxial epidermis forms transmitting tissue, lines ovarian locules, and contributes to ovule integuments. As dehiscence approaches, cytoplasm in carpellary cells is catabolized by what appear to be autophagic vacuoles and the cells then collapse. Outer walls of adaxial epidermal cells are very thick but eventually curl inward and become U-shaped. This curling apparently provides sufficient stress for the carpels to dehisce along suture lines.

3:00 THE ULTRASTRUCTURE OF THE FLAGELLAR APPARATUS OF TWO COLONIAL VOLVOCALEAN ALGAE, UVA AND CHLORCORONA. Harold J. Hoops and Gary L. Floyd. The Ohio State University Dept. of Botany, 1735 Neil Ave., Columbus, OH 43210.

These two unusual algae were found in their natural habitat and fixed for electron microscopy. In both cases the flagella emerge about 120° apart and to the side of the cell. In each case there is a fiber that is similar in striation pattern and relative position to the distal fiber of Chlamydomonas. There are cruciate, alternating 3 over 1 and 2 membered rootlets with one pair inserting under the distal fiber. In addition to the two basal bodies which support flagella, 2 accessory basal bodies are present. There is an amorphous substance between the two functional basal bodies and one of the two accessory basal bodies. Other structures include fibers that are associated with the 3 over 1 rootlets and attached to the functional basal bodies, an apparently unstriated fiber that also connects the functional basal bodies at the anterior most end of the cell, and a striated component associated with the 2 membered rootlet. In addition a much reduced rhizoplast is present in Uva, but has not been seen in Chlorcorona. These two algae have a type of symmetry uncommon in the green algae which is probably related to the unusual form of the colonies. Similarities in the ultrastructure of these two algae support placing Chlorcorona, formerly of uncertain taxonomic position, in the same family as Uva.

3:15

WITTROCKIELLA PARADOXA: STRUCTURE AND REPRODUCTION OF A SALT MARSH ALGA. Charles J. O'Kelly and Gary L. Floyd, Department of Botany, Ohio State University, 1735 Neil Avenue, Columbus, Ohio 43210.

Wittrockiella paradoxa (Chlorophyta, Cladophorales) is a diminutive marine alga usually found in salt marshes, where it may grow on bare mud or as an endophyte in marine phanerogams. In nature and in culture, it demonstrates broad tolerances to extremes of temperature and salinity, and can withstand almost complete dryness. The alga has evolved several structural and reproductive modifications that allow it to cope with its environment. For example, the sporangia and gametangia have developed abnormally long exit tubes to insure the dispersal of spores and gametes above the algal mat or outside of the host plant. These modifications have confused phycologists that have attempted to place this alga in its proper systematic position. It has, however, preserved the essential features that identify it as a member of Cladophorales. The internal structure of the sporangia and gametangia, and the ultrastructural features of the motile cells, are unchanged from the Cladophoralean type. The sexual life history is also typically Cladophoralean, but with modifications suited to the habitat. Even though Wittrockiella paradoxa has distinctive structural characteristics, it has conserved the features considered to be critical markers of phylogenetic relationships within the green algae.

## B. PLANT SCIENCES

SECOND AFTERNOON SESSION

105 KAUK HALL

1:30

ADAPTIVE RADIATION OF THE COMPOSITAE OF THE JUAN FERNANDEZ ISLANDS: A PROGRESS REPORT. Roger W. Sanders and Tod F. Stuessy. Department of Botany, Ohio State University, Columbus, Ohio 43210 U.S.A.

A study of the chemistry and adaptive radiation of the Compositae of the Juan Fernandez Islands is in progress at the University of Concepción and Ohio State University. Recent findings in the comparative cytology, morphology and ecology are reported. Seven species of Dendroseris now are known to share the chromosome number  $n=18$ . Chromosome numbers of several other genera also have been counted. Based on morphology, phylogenetic diagrams have been developed to estimate the evolutionary branching patterns. Principal Components Analysis of soil and vegetational factors reveals that related species do not occupy radically different habitats. This suggests that the species did not adaptively radiate *in situ* but evolved formerly either on a larger land mass or at least on the existing islands during a period of greater ecological zonation.

1:45

MULTIVARIATE ANALYSIS OF MORPHOLOGICAL VARIATION IN THE ACMELLA AMERICANA (COMPOSITAE:HELIANTHEAE) POLYPLOID COMPLEX. Robert K. Jansen. Department of Botany, The Ohio State University, Columbus, Ohio, 43210.

The Acmella americana complex is composed of annual to perennial herbs which are characterized by their prostrate to decumbent habit and yellow to orange-yellow ray and disc florets. Recent studies reveal that this complex exhibits much chromosomal variation with taxa occurring at the diploid, triploid, tetraploid, pentaploid, and hexaploid levels. In addition to the occurrence of polyploidy there is evidence of apomixis and hybridization. All of these factors contribute to the complicated patterns of morphological variation exhibited by the complex. To aid in understanding these patterns and to resolve taxonomic problems two types of multivariate analyses were performed using 75 morphological characters and 85 populations. First, factor analysis (BMDP4M) was conducted in order to determine major groups within the complex. The results suggest that there are seven morphologically distinct groups which merit recognition at the species level. Five of these are at the diploid level and the remaining two are tetraploids. In addition, there were a number of populations which did not fit into any of these seven groups. These populations consisted of suspected diploid hybrids, triploids, tetraploids, pentaploids, and hexaploids. To place these populations stepwise discriminate analysis (BMDP7M) was performed. The seven groups from the factor analysis were entered as knowns and the probability of the unplaced populations fitting into these seven groups was determined. The results of the discriminate analysis with respect to the classification of the unplaced populations are discussed.

THE EFFECTS OF TIMBER STAND IMPROVEMENT ON THE HERBACEOUS VEGETATION LAYER OF A SOUTHERN OHIO FOREST. Raymond W. Strom and Warren A. Wistendahl. Ohio University, Athens, Ohio, 45701.

2:00

In the early to middle 1950's, a series of practice logging plots were set up along a single ridge in the Mead Experimental Forest, Vinton Co., Ohio. The regrowth of the various tree species on the plots has been monitored over the following 25 year period for each plot. Also, half of the plots have received a Timber Stand Improvement (TSI) treatment process over the years. TSI improves the overall quality of a timber stand by periodically selectively cutting old, weakened or misshapen trees. It is the intent of this paper to examine the effect of TSI on the herbaceous layer of vegetation in the forest. Identically cut plots with and without TSI were sampled, along with an uncut control plot, between June and October, 1980. Soil samples are currently being obtained for analysis. Computer analysis of the data collected over the summer is currently underway.

THE BERBERIDACEAE OF OHIO. Henry Loconte and Will H. Blackwell, Department of Botany, Miami University, Oxford, Ohio 45056.

2:15

Objectives of this study were to document the taxonomy, geographical distribution, and life histories of Ohio's berberidaceous plants, including both introduced shrubs and the three genera of native woodland herbs. Nonintrinsic species of *Berberis* and *Mahonia* are cultivated throughout the state. For example, *Berberis thunbergii*, the Japanese barberry, has escaped and become naturalized in all 88 counties. By contrast, an attempt has been made to eradicate *Berberis vulgaris* (European barberry) in Ohio because of its role as alternate host for the fungus causing black stem rust of wheat.

The indigenous herbs are primitive geophytes of the deciduous forests. Their life cycle development takes place primarily before and during vernal canopy expansion. *Podophyllum peltatum* (Mayapple) is recorded from every county in the state. The twinleaf, *Jeffersonia diphylla*, has been found in 54 counties, usually associated with calcareous outcrops. *Caulophyllum thalictroides* (blue cohosh) prefers mesic sites such as floodplains and woodland swamps; it has been recorded from 74 counties. In contrast to prevailing opinion, an investigation into the systematics of blue cohosh supports the recognition of two North American taxa which have overlapping geographic ranges in Ohio.

THE COMPOSITION, STRUCTURE, AND PHENOLOGY OF THE O.E. ANDERSON COMPASS PLANT PRAIRIE INCLUDING POPULATION DYNAMICS OF *SILPHIUM LACINIATUM* L. (COMPASS PLANT). Thomas M. Auffenorde and Warren A. Wistendahl Ohio University Dept. of Botany Athens, OH 45701

2:30

The vegetation of the O.E. Anderson prairie, near Aid in Lawrence Co. Ohio, includes a disjunct population of *Silphium laciniatum*. A study of the vegetational features of the site and some of the populational characteristics of *S. laciniatum* was initiated in the spring of 1980. The vegetation was randomly sampled in 75 quadrats of 1 square meter. The sample contains 175 species of vascular plants representing 58 families. Some prairie indicator species present include *Andropogon gerardii*, *A. scoparius*, *Sorghastrum nutans*, *Sporobolus asper*, and *Silphium laciniatum*. Of these, *A. scoparius* was dominant and species of the Compositae were well represented. The lower portion of this northwest facing slope (20%) is underlain by limestone and the upper by sandstone. The site has a history of grazing and also contains some woody plant species, most noticeably, *Pinus virginiana*. Phenologically this area exhibits two flowering pulses, one in early June and the other in late August. The flowering period for *S. laciniatum* was from mid July through mid September. Of the 765 individuals comprising this population 28 produced flower stalks in the 1980 growing season. Ten flower heads were bagged to prevent cross pollination and these mostly did not set seed. Coleopteran, Dipteran, and Hymenopteran species were observed as possible pollinators.

2:45 ABSENCE OF CERTAIN AQUATIC VASCULAR PLANTS FROM THE PRAIRIE PENINSULA. Ronald L. Stuckey. Department of Botany, The Ohio State University, Columbus, Ohio 43210.

Examination of distribution of maps of eastern North American aquatic vascular plants reveals that certain species are rare or absent from the Prairie Peninsula--glaciated Illinois, central Indiana, and western Ohio. Examples are Sparganium americanum, Potamogeton epihydrus, P. pulcher, Najas gracillima, Carex decomposita, Eleocharis quadrangulata, and Decodon verticillatus. These species are generally common in the Middle Atlantic States, more scattered throughout the southern and Mississippi valley lowlands, and extend northward into the western Great Lakes region. In southeastern Missouri they are generally restricted to unglaciated upland sink-hole ponds formed during the last Ozarkian uplift in late Tertiary time. The plants of these ancient relic ponds would have been available for an immediate northward migration following retreat of the Wisconsin glacier. Their present-day distribution in the glaciated territory of the western Great Lakes region is evidence that this migration occurred. Their absence from the Prairie Peninsula, as suggested by H.A. Gleason (1923) in his Vegetational History of the Middle West, may be explained by the warm dry climatic time, the Xerothermic Period, from 8,000 to 4,000 years B.P., when the ponds and shallow lakes would have become dry and the plants would not have survived. Additional confirming evidence should be sought among preserved aquatic plant macrofossils from lake sediments in the region. These species are also of waters more acidic than alkaline, and this factor may also be of importance since the plants are generally absent from areas underlain by calcareous bedrock, as is evident in Ohio, where the species are much more common in the eastern portion.

3:00 THE ALNUS INCANA COMPLEX IN NORTH AMERICA. John J. Furlow. Department of Botany, The Ohio State University, Columbus, Ohio 43210.

Alnus incana (L.) Moench is a variable species of trees and shrubs of circumpolar distribution. In North America it exists as two morphologically and geographically well-marked segments, subspecies rugosa in the northeastern part of the continent and subspecies tenuifolia in the western. Closely related to these taxa is a second quite distinct species, Alnus serrulata (Aiton) Willdenow, this occurring throughout the eastern portion of the United States and southeastern Canada. Where the ranges of any pair of these three taxa overlap occur hybrid swarms, and in the case of A. incana subsp. rugosa and A. serrulata, hybridization is accompanied by apomixis. Because of this and the morphological variability of the species, the complex has been a source of considerable taxonomic and nomenclatural confusion for many years. Numerical taxonomic analyses have been performed to assess the nature of phenetic variation and relationships in the group as a whole, including the European and Asian vicariants. The results of this study support the view that the American taxa traditionally known as Alnus rugosa (DuRoi) Sprengle and A. tenuifolia Nuttall are best treated as conspecific with the Eurasian A. incana, as outlined above, that A. serrulata is a distinct species derived from this group, and that several widely-accepted named varieties of these taxa represent only extremes in variational patterns not deserving of formal taxonomic recognition.

## B. PLANT SCIENCES

THIRD AFTERNOON SESSION

125 KAUKU HALL

1:30 PHOTOINDUCTION OF SPORE GERMINATION IN THE FERN, MOHRIA CAFFRORUM. Thomas L. Reynolds and V. Raghavan. Department of Botany, The Ohio State University, Columbus, Ohio 43210.

Fully imbibed spores of Mohria caffrorum begin to germinate with the rupture of the exine and protrusion of the rhizoid initial within 48 hours of exposure to inductive light treatments. Irradiation of spores with either red light ( $67.4 \mu\text{W cm}^{-2}$ ) or far-red light ( $410 \mu\text{W cm}^{-2}$ ) induces maximum levels of germination. Prolonged exposure of spores to blue light ( $166 \mu\text{W cm}^{-2}$ ) suppresses germination, while brief irradiations, administered before or after maximum potentiation, completely nullify the photoinductive effects of red or far-red light. The promotion of spore germination by red and far-red light to the same extent, seems to discount the involvement of a simple, phytochrome-mediated mechanism in the photoinductive process. The photoinhibitory effect of blue light appears to involve a separate blue light absorbing pigment. The possible interactions of these systems during germination will be discussed.

LEAF ELONGATION RATES IN BEAN: A SENSITIVE METHOD FOR STUDYING THE EFFECT OF CHANGES IN WATER STATUS. McFadden, J.J. and C.A. Swanson. Dept. of Botany, The Ohio State University, Columbus, Ohio 43210.

1:45

Several recent reports in the literature (Plant Physiol. 66:147-152, Science 168:590-591) have dealt with measurement of leaf elongation rates using electronic linear or angular transducers. This general method has been adapted for use with bean plants (Phaseolus vulgaris L. cv Black Valentine) by using an angular transducer to measure the elongation growth of the primary leaf. Growth rates in the range of 5 - 12  $\mu\text{m}/\text{min}$  were obtained, with little difference between day and night elongation rates. This compares with rates of 60  $\mu\text{m}/\text{min}$  for corn and 60-100  $\mu\text{m}/\text{min}$  for rice.

Source leaf excision experiments confirm that leaf growth is primarily dependent on the water status of the plant. Heat girdled bean plants modified to a single-source, single-sink arrangement showed little change in growth rate 3 hours after source excision. Changes in water status or other environmental variables had significant short term effects on growth rates, however, demonstrating that LER are only indirectly dependent on organic translocate supply.

THE EFFECT OF AUXIN ON ROOT HAIRS OF ZEa MAYS. Marsha A. Forrest and Michael L. Evans. Dept. of Botany, The Ohio State University, Columbus, Ohio 43210.

2:00

A technique has been designed to measure the growth of single root hairs of Zea mays. The technique involves the observation of root hairs with a horizontally mounted microscope and ocular micrometer at ten minute intervals. Measurements obtained at a resolving power of 100X allows rate measurements to be expressed in micrometers/hr. It is well established that indole - 3 - acetic acid (IAA) stimulates coleoptile growth optimally in the range of 1 to 10 micro-molar, and that root growth is stimulated optimally at much lower IAA concentrations (1 to 10 nano-molar). The growth of Zea root hairs are stimulated by concentrations of IAA which are physiologically active in coleoptile tissue.

PHYTOTOXICITY OF PH INDICATOR DYES USED FOR THE STUDY OF  $\text{H}^+$  EFFLUX/INFLUX FROM ROOTS OF ZEa MAYS. Marsha A. Forrest, Timothy J. Mulkey, Konrad M. Kuzmanoff and Michael L. Evans. Dept. of Botany, The Ohio State University, Columbus, Ohio 43210.

2:15

The difficulty of measurement of  $\text{H}^+$  ions movement into the cell wall during auxin mediated growth has long been one of the major problems concerning the Acid Growth Theory. One recent approach (Plant Physiol. 64:512, Plant Physiol. 65,VI:75) has centered on the use of pH indicator dyes in the determination of  $\text{H}^+$  fluxes from intact tissues. Phytotoxicity of many dyes prohibits their use. Fifteen common pH indicator dyes were assessed for toxic effects on root growth using a root auxinometer. The majority of the dyes; including methyl red, propyl red, eriochrome black T, chlorophenol red, bromothymol blue, neutral red, and curcumin; are phytotoxic. Very few dyes, such as bromocresol purple, thymol blue and resazurin, appear non-toxic and suitable for  $\text{H}^+$  measurement of root growth in Zea mays.

EFFECTS OF ETHYLENE-INHIBITING COMPOUNDS ON ROOT GROWTH IN ZEa MAYS. Timothy J. Mulkey, Konrad M. Kuzmanoff and Michael L. Evans. Dept. of Botany, The Ohio State University, Columbus, Ohio 43210

2:30

Application of supraoptimal levels of indole - 3 - acetic acid (IAA) causes inhibition of elongation. Chadwick and Burg (Plant Physiol. 45, 1970) propose that virtually all such inhibition results from IAA - dependent ethylene production. We have found that for intact roots the application of ethylene inhibiting agents, amino-oxy acetic acid (AOA) and aminoethoxy vinyl glycine (AVG), increases the rate of root growth. Subsequent applications of inhibitory concentrations of IAA (10 nano molar - 1 micro molar) results in decreased inhibition by IAA. These results implicate ethylene as the mediator of auxin action in the control of normal root growth a development.

CORRELATION OF H<sup>+</sup> EFFLUX PATTERNS WITH TROPIC RESPONSES IN ROOTS AND STEM TISSUES. Timothy J. Mulkey, Konrad M. Kuzmanoff, and Michael L. Evans. Botany Dept., The Ohio State University, Columbus, Ohio 43210.

2:45

The elongation zone of growing intact corn roots secretes acid leading to a reduction of pH along the surface of the root and of the adjacent medium. This efflux can be detected by placing the tissue on an agar medium containing the pH indicator dye, Bromocresol purple. When roots are mounted horizontally there is enhanced acid efflux along the upper surface of the elongation zone and reduced acid efflux along the lower surface. This is followed by increased elongation of the upper cells relative to the lower cells. Downward curvature of the root results. A similar phenomenon is observed in negative geotropic curvature of abraded sunflower stems and corn coleoptiles.

The phototropic response results in enhanced acid efflux and cell elongation on the side distal to the light exposure in abraded sunflower stems and corn coleoptiles. Decreased acid efflux and cell elongation on the light proximal surface is observed. The correlation between acid efflux patterns and growth patterns indicate that proton efflux plays an important role in the control of growth in intact tissues.

THE DIAGEOTROPIC TOMATO: A TOOL FOR STUDYING ETHYLENE INTERACTIONS IN PLANT METABOLISM. Timothy J. Mulkey and Forrest E. Lane\*, Botany Dept., The Ohio State University, Columbus, OH 43210. \* Botany Dept., University of Arkansas, Fayetteville, Ark. 72764.

3:15

The diageotropic (dgt) mutant of tomato (*Lycopersicon esculentum* Mill.) is characterized by diageotropic growth of the shoots and roots; dark green hyponastic leaf segments; thin rigid stem segments; and roots which lack lateral root primordia. The dgt mutant is an ethylene-requiring plant which results from a single point mutation on the first chromosome of the tomato variety VFN-8.

Higher chlorophyll levels were associated with the more highly developed granal lamella of the dgt mutant. Ethylene exogenously applied, decreased chlorophyll levels and increased chlorophyllase activity in the mutant toward the levels found in the normal isogenic parent variety. Hill reactivity (2,6 - dichlorophenol indophenol reduction) was greater in the dgt mutant. These results indicate that the dgt mutant is an excellent research plant for studying the biological significance of ethylene action at normal endogenous levels.

DETERMINATION OF THE FREE SPACE PRESENT IN THE PRIMARY ROOT OF LENTIL. Konrad M. Kuzmanoff and Michael L. Evans Dept. of Botany, The Ohio State University, Columbus, Ohio 43210

3:30

The free space of three day old lentil roots was approximated using a modified technique described by Kapteyn (PhD Thesis Univ. of Toronto, 1967). Labelled mannitol was utilized as a tracer.

Multiple sample measurements suggest an apparent free space of 24.1% (+/- 0.6%) for primary roots 3 cm in length. This indicates that the total amount of mannitol moving into the root tissue is less than 2.5 micro-moles for a 0.4M mannitol solution.

As previously reported (Ohio J. Sci. 78, 1978) the ability of primary roots to rapidly adapt to low external water potentials apparently does not involve osmotic adjustment. This determination of mannitol entry into the free space supports the previous conclusion.



CHARACTERIZATION OF A COMPONENT APPARENTLY INVOLVED IN THE ACID - INDUCED GROWTH RESPONSE OF ROOTS. Konrad M. Kuzmanoff and Michael L. Evans. Dept. of Botany, The Ohio State University, Columbus, Ohio 43210.

3:45

Rubenstein (Pl. Phys. 59, 1977) reported that osmotic shock resulted in the loss of both auxin and acid - induced growth. Masuda et al. (Pl. and Cell Physiol. 19, 1978) suggested that the loss of the auxin response in Avena coleoptiles resulted from the release of an essential elongation factor from the cell walls. Brief osmotic shock (50 % polyethylene glycol 4000) or treatment with a chaotropic agent (8M urea) results in the release of a component from both soybean and corn roots. The rate of release of this component differs for the two root types. However, Concomitant with the appearance of this componet is the loss of the acid - induced growth response.

Isolation and purification of the component reveals a UV absorption maximum centered at 260 nm. Initial analysis suggests that this component is composed of both protein and carbohydrate.

DIGITIZED MEASUREMENTS OF SHORT TERM GROWTH KINETICS OF SOYBEAN CORN AND LENTIL ROOTS. Konrad M. Kuzmanoff and Michael L. Evans. Dept. of Botany, The Ohio State University, Columbus, Ohio 43210

4:00

Discrete analog measurements of short term root growth kinetics inevitably suffer from low resolution. Digitization of analog information to allow for numeric manipulation of the data alleviates the problem of low resolution only if a high resolution, large range A/D converter is available.

Using available LSI circuits, an inexpensive A/D module can be designed which provides resolution of at least 15 bits over a 2 volt range. The circuit requires few hardware components and relies upon software for the final conversion from analog to digital signals. Under software control, the digitization process, employing an IMSAI PCS-42 microcomputer, requires about 128,000 measurements to achieve precision of 4 micrometers over a 1mm range. The digitization is linear, within 0.1%, over the entire range of 0 to +2 volts, and requires 0.48 seconds for conversions with the desired precision.

The application of microcomputer data aquisition to growth measurement studies shall be discussed.

## C. GEOLOGY

FIRST MORNING SESSION

102 SCOVEL HALL

MARK J. CAMP, PRESIDING

WARPED EROSION SURFACES OF OHIO. F. L. Koucky, L. Tichy, and J. Kasserman, The College of Wooster, Wooster, Ohio 44691.

9:00

The often discussed problem of correlating erosion surfaces in Ohio is reviewed. Flat areas on uplands were outlined on the newer topographic maps of Ohio.

Assuming less than 20 feet of overlying drift, these areas were assigned an average elevation. When the data were assembled for southwestern Ohio, the resulting surface proved warped into two broad low amplitude north-south trending anticlines and associated syncline.

Most drainage of Ohio flows parallel to these structures but both the ancient Teays River and the modern Ohio River traverse these structures. The ancient Teays River valley is filled with Minford silts in contrast to deep-stage valleys which were choked with outwash gravels. Thus the bedrock gradient of the Teays can be distinguished and mapped in a limited number of locations. The Teays appears to have suffered the same warping as the erosional surface, suggesting much of the deformation to be Illinoian and Wisconsinian.

The cause of the deformation may be non-recovered mantle flowage due to the weight of Pleistocene ice lobes. The warped surface hypothesis allows possible correlation of the Worthington and Harrisburg surfaces.

THE MECHANICS OF NATURAL ROCK SLOPE EVOLUTION NEAR YELLOW SPRINGS, OHIO.  
Thomas M. Tharp, Department of Geosciences, Wright State University, Dayton, Ohio  
45435.

9:15

Progressive failure of steep natural slopes in Middle Silurian dolomite along Yellow Springs Creek and the Little Miami River occurs by several mechanisms. Massive Cedarville dolomite is undermined by removal of the weaker Springfield dolomite. The Cedarville then protrudes from the cliff face as an overhanging cantilever which becomes longer as the Springfield is progressively cut back. Tensile stress increases with length, and failure occurs when the tensile strength of the cantilever is exceeded. Back calculation of tensile strength suggests a value of roughly 100 lb/in<sup>2</sup>. Some horizontally jointed cantilevers may fail initially by flexural slip on joints, which increases tensile stress to the point of failure.

Other slopes fail along steeply dipping zones of rotational shear. It is suggested that in the zones of rotation, rectangular blocks are tilted slightly so that uniform loads are replaced by loading on only a few points. This induces secondary vertical joints as well as diagonal joints. Sliding is possible on the diagonal joints, and the tendency for block rotation is enhanced for the tall thin blocks resulting from decreased spacing of vertical joints. This represents a strength reduction along the rotation zone and leads eventually to failure.

ON THE ORIGIN OF THE EARTH-MOON SYSTEM: SOME POSSIBLE GEOLOGICAL SIGNATURES FOR LUNAR CAPTURE. R. J. Malcuit, Dept. of Geology and Geography, R. R. Winters, Dept. of Physics and Astronomy, Denison University, Granville, Ohio 43023

9:30

Two geological patterns, one lunar and one terrestrial, can be interpreted as signatures of the lunar capture process. The lunar feature is a great-circle pattern of large circular maria. The western end of this pattern is marked by Mare Orientale and the eastern end by the mare-filled Crater Tsiolkovsky. In between are Maria Imbrium, Serenitatis, Crisium, and Smithii. Computer simulation studies suggest that this great-circle pattern could have been generated during a very close gravitational encounter between Moon and Earth early in Solar System history. The encounter must have been close enough to cause tidal disruption of the Moon at the sub-Earth point but distant enough to prevent collision. The circular maria are interpreted as impact sites of large spheroids of lunar basalt which necked off from an eruption zone near the sub-Earth point during the encounter and then were transferred in sub-orbital trajectories to the impact sites. The terrestrial signature is mainly geochemical. Studies of the U-Th-Pb, Rb-Sr, and Sm-Nd isotope systems suggest that the Earth's crust-upper mantle system began a second stage of differentiation somewhere between 4.0 and 3.6 billion years ago. The process can be interpreted to be the result of a major thermal episode on Earth. In our lunar capture scenario, these two events are considered to be co-temperaneous. The lunar pattern was generated during the capture encounter (about 3.9 to 4.0 b.y. ago) and the terrestrial signature resulted from both the thermal impulse of capture and of the subsequent early geocentric evolution of the lunar orbit.

THE GEOPHYSICS AND GEOLOGY OF OHIO'S SEISMIC AREA. Noel, James A.,\* and Heidorn, Marjorie A.,<sup>1</sup> Wright State University, Dayton, Ohio 45435.

9:45

Gravity, magnetic and subsurface geology studies were made of Auglaize, adjoining parts of Logan and Darke and the northern half of Shelby counties. Gravity and magnetic readings were taken at all road intersections. The residuals were calculated using the "Stampede System" which generates mathematical surfaces by least squares analysis from the Bouguer and total Magnetic Intensity maps, fits the surface to and subtracts it from the Bouguer and magnetic maps. Third order residuals were used in the interpretations. The subsurface data was taken from geophysical logs, samples, and scout data on file at the Ohio Geological Survey.

Comparisons among the gravity residual, structure contour, isoseismal and oil field maps led to the interpretation of three faults in the area. These faults all trending northeast southwest and named, from west to east: Shawnee, Auglaize, and Bowling Green Branch Faults. The Shawnee Fault extends from St. Marys Township in Auglaize County to Shawnee Township in Allen County, is down-dropped on the northwest and has a displacement of 15-35 feet. The Auglaize Fault extends from Van Buren Township in Shelby County to Perry Township in Allen County and is down-dropped on the southeast by 25-40 feet. The Bowling Green Branch Fault is a southwestern off-shoot of the Bowling Green Fault, extends from Washington Township, Shelby County northeastward to Auglaize Township, Allen County and is down-dropped on the northwest 40 to 80 feet.

\* speaker; <sup>1</sup> present address: Chevron Oil Company, New Orleans.

10:00

Furnace Run, a southeasterly flowing tributary of the Cuyahoga River, has an asymmetrical drainage basin. Many of the tributaries have convex long profiles and are commonly wider upstream than downstream. Western tributaries are generally much longer than eastern ones. For most of their lengths eastern tributaries flow through interbedded shale and siltstone of the Mississippian Cuyahoga Group. These rocks also crop out in low spots along Furnace Run. Western tributaries flow through lower Wisconsinan deposits consisting of: silts interbedded with a hard silty till; laminated silts and clays; and a clay till. All of these deposits are very susceptible to slump and earth flow. A morphometric analysis was conducted in order to describe quantitatively the tributary basins. Parameters considered include drainage densities and bifurcation, length, area and slope ratios.

It is thought that the asymmetrical drainage is due to postglacial realignment of the river along the edge of its filled paleovalley. The narrowness of the downstream reaches of the tributaries may be caused by unstable bank materials or by rejuvenation. Noncyclical cut terraces imply that downcutting has occurred through the Recent.

10:30 BUSINESS MEETING

## C. GEOLOGY

SECOND MORNING SESSION

202 SCOVEL HALL

F. W. CROPP, PRESIDING

THE GEOCHEMISTRY AND PETROGENESIS OF AN ARCHEAN ULTRAMAFIC COMPLEX OF THE SOUTHERN CANADIAN SHIELD, MARQUETTE COUNTY, MICHIGAN. William A. Reinthal, The College of Wooster, Wooster, Ohio 44691.

9:00

The geochemistry of the ultramafic, mafic, and sialic intrusive and extrusive rocks surrounding the city of Marquette, Michigan, is examined. Major and minor oxides as well as a variety of trace elements have been analyzed using inductively coupled plasma emission spectroscopy and a lithium metaborate fusion sample digestion for the whole-rock analyses. The geochemistry is compared to that of other ultramafic to mafic complexes (e.g. ophiolites, komatiites) and related to present knowledge of Archean crustal evolution.

The geochemistry and the results of the petrographic analysis of the various rocks in the unit combined with field observations leads to several conclusions concerning the petrogenesis of the Marquette ultramafic complex: 1) compositional trend analysis of the unit from the serpentinized peridotite through the ellipsoidal metabasalts; 2) nature of the Archean crust in that locality and its ability to support tectonic emplacement of the "ophiolite" sequences; and 3) comparison of the Archean complex with what is acknowledged as the manner in which ultramafic complexes have been emplaced during Phanerozoic time.

STRATIFORM SULFIDE DEPOSITION IN A SIMULATED SABKHA ENVIRONMENT. Daniel O. Hayba, United States Geological Survey, Reston, Virginia and David M. Land, The College of Wooster, Wooster, Ohio 44691.

9:15

Stratiform evaporite-associated metalliferous deposits contain much of the world's copper reserves. Renfro (1974) has related the sedimentary and geochemical processes of coastal sabkhas to the genesis of these deposits. This hypothesis was tested in a model of the sabkha, similar to one used by Hsu and Siegenthaler (1969) to study the dolomite problem.

The landward margin of a sabkha is the area of mixing of marine and terrestrially derived groundwaters. A buried algal mat, resulting from a regressive sea, produces hydrogen sulfide, carbon dioxide, and methane gas as it decays. High Eh - low pH, terrestrial groundwater can carry metal ions in solution. The low Eh of the algal mat and the high pH of the marine groundwater cause the metal ions to precipitate as the terrestrial groundwater is drawn up by evaporation through the algal mat. The metal ions are thus precipitated as sulfides according to their solubilities. The model tested this hypothesis by introducing metal ions into the terrestrial groundwater, and drawing this water up through a sulfide-producing layer by evaporative pumping. At the completion of each run, minicores were taken and each sample analyzed for its metal content. Results from atomic absorption analysis showed that there was a zoning of metals according to their solubilities in agreement with Renfro (1974).

PETROGRAPHIC AND STRUCTURAL ANALYSIS OF THE STRONGHOLD GRANITE AND THE TECTONIC IMPLICATIONS FOR SOUTHEASTERN ARIZONA. Edward D. Young, The College of Wooster, Wooster, Ohio 44691.

9:30

The Stronghold Granite is a post-Laramide (mid-Tertiary) granite pluton situated within the central portion of the Dragoon Mountains in the Basin and Range Province of southeastern Arizona. Petrographic study combined with fracture data analysis of the pluton is used to deduce the thermal environment and mechanics of intrusion of the granite body. The influence of this magmatic event upon the complex structure of the central Dragoon Mountains is inferred. The Dragoon Mountains area has been cited as evidence for opposing views regarding the dominant style of Laramide tectonism in southeastern Arizona. This study of the Stronghold Granite increases the understanding of the local structure and provides evidence for further interpretations of regional tectonics.

STRONTIUM ISOTOPE STUDIES OF COAL BALLS FROM EASTERN OHIO

Jack Kovach, Department of Geology, Muskingum College, New Concord, Ohio 43762

9:45

Coal balls (nodular masses of plant material permineralized by calcite) occasionally occur within coal seams of Pennsylvanian age in local areas. The source of the permineralizing calcite in "normal" coal balls (i.e., those lacking recognizable marine fossils or sediments) has been problematic, but most workers have attributed its occurrence to influxes of marine waters into coastal marshes or to marine inundations of the original peat beds.

The  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios of carbonate leached with 0.1N HCl from pulverized, whole-rock samples of "normal" coal balls from 5 coal seams of Pennsylvanian age from 4 localities in eastern Ohio range from 0.7096 to 0.7108. Rb and Sr contents of the whole-rock samples were determined by X-ray fluorescence. Sr concentrations ranged from 297 to 956 ppm, but no Rb was detected. The measured  $^{87}\text{Sr}/^{86}\text{Sr}$  ratios are significantly higher than reported values of the  $^{87}\text{Sr}/^{86}\text{Sr}$  ratio of Pennsylvanian seawater and indicate that the carbonate now present in the coal balls was not entirely derived directly from a marine source. However, evidence for the occurrence of multiple episodes of calcite precipitation is seen in all samples studied -- an early episode of permineralization followed by one or more episodes of infilling of secondary cracks and cavities. Hence, further studies of the Sr isotopic composition of the separate carbonate generations are needed to clarify the nature and origin of the mineralizing fluids involved in the formation and diagenesis of coal balls.

THE GEOLOGY OF OGLEBAY PARK AND VICINITY, WHEELING, WEST VIRGINIA. Timothy R. Basilone and F. W. Cropp, The College of Wooster, Wooster, Ohio 44691.

10:00

Oglebay Park, part of the Wheeling, West Virginia park system, comprises 1460 acres of city parkland used primarily for educational and recreational purposes.

Few of the 2.5 million annual visitors to Oglebay realize that the bedrock in the area is among the youngest Paleozoic rocks in the eastern United States. Rocks of the Monongahela and Dunkard cyclothems, which are exposed in the Ohio River Valley around the Oglebay region, were deposited in the Dunkard Basin during the Pennsylvanian and Permian.

The region is maturely dissected by a dendritic drainage system which includes examples of stream piracy or reversal of flow.

Many of the hills around the Oglebay Park region are susceptible to landslides.

The Wheeling area, which is the present center of many industries, has been populated since at least A.D. 500 to A.D. 1000, when burial grounds south of Wheeling were constructed.

10:15 RECLAIMING COAL STRIP-MINED AREAS IN HOLMES COUNTY, OHIO. Emanuel Mullet, Merle Mullet, Wade Mullet, Holmes Limestone Company, Box 295, Berlin, Ohio 44610 and F. W. Cropp, The College of Wooster, Wooster, Ohio 44691.

The Holmes Limestone Company has been mining coal, limestone, clay, and shale in Holmes County and vicinity for more than 30 years. While the company exceeded all Ohio reclamation requirements during its first 20 years, for the past 12 years a program of total reclamation has been the policy of Holmes Limestone Company in this pre-dominantly Amish farming area.

During the past decade an average of 400,000 tons/year of Brookville, Lower Kittanning, Middle Kittanning, and Upper Freeport Coal have been mined. The Brookville Underclay, Putnam Hill Limestone, Clarion Shale and shale above the Upper Freeport Coal also have been mined. The total reclamation program includes restoring the land to its original contour, returning 22 to 24 inches of subsoil and all topsoil, adding lime, and seeding in addition to assuring drainage and water management. The program takes two years from the time strip-mining begins to the time wheat is planted; the wheat is harvested during the next growing season.

In 1980 the Mining and Reclamation Council of America selected several Holmes Limestone Company sites among "10 examples of great reclaimed lands" in America. This area will be visited on the 1981 Ohio Academy of Science Geology Field Trip.

10:30 BUSINESS MEETING 202 SCOVEL HALL

## C. GEOLOGY

FIRST AFTERNOON SESSION

102 SCOVEL HALL

MARK J. CAMP, PRESIDING

1:30 THE PENNSYLVANIAN GASTROPOD GENUS DONALDINA KNIGHT IN THE APPALACHIAN BASIN  
J. R. Anderson and R. D. Hoare, Department of Geology, Bowling Green State University, Bowling Green, OH 43403 and M. T. Sturgeon, Department of Geology, Ohio University, Athens, OH 45701

Donaldina is a common to abundant taxon in Pennsylvanian marine units. Specimens collected from nine units in the Appalachian Basin, Lower Mercer to Ames, include four previously named species and two new species. Species of Donaldina are typically long ranging, showing little morphologic change, which appears to support a punctuated equilibria model. Shouldered and nonshouldered taxa are commonly found associated which may indicate some type of dimorphism.

1:45 THE PENNSYLVANIAN GASTROPOD GENUS PSEUDOZYGOPLLEURA KNIGHT IN THE APPALACHIAN BASIN  
R. D. Hoare, Department of Geology, Bowling Green State University, Bowling Green, Ohio 43403 and M. T. Sturgeon, Department of Geology, Ohio University, Athens, Ohio 45701

Representatives of the family Pseudozygopleuridae Knight are a common component of molluscan dominated faunas in the Pennsylvanian System of the Appalachian Basin. The genus Pseudozygopleura is the most diverse and prolific taxon present ranging from the Lower Mercer unit in the Pottsville Series to the Ames unit in the Conemaugh Series with at least 50 species being recognized. The subgenera Pseudozygopleura Knight and Pyrogozyga Knight are believed to be indistinguishable. The subgenus Leptozyga Knight is retained as a valid taxon. The subgenus Stephanozyga Knight is a questionable pseudozygopleurid.

The Permian genera Palaeostylus Mansuy, within which the taxa discussed here have been previously placed, and Spiromphalus Hayasaka are not pseudozygopleurids. Sinistral species previously assigned to the genus Pseudozygopleura and the large loxonematids with coarse ribs or nodes, present in the Pottsville and Lower Allegheny units, lack pseudozygopleurid protoconchs.

2:00

Twenty-six tetrapod genera are known from the carbonaceous shale underlying the Middle Pennsylvanian Upper Freeport Coal (Westphalian D) of Linton, Ohio. All three orders of the amphibian subclass Lepospondyli are represented. The aistopods Ophiderpeton amphiunum and Phlegethontia linearis are known from numerous specimens. Similarly, the nectrideans are well represented by three urocordylids, Sauroplorea pectinata, Ptyonius marshii, and Ctenerpeton remex; two keraterpetontids, Diceratosaurus brevisrostris and Keraterpeton sp.; and a single specimen possibly referable to the Scincosauridae. The microsaurs Tuditanus punctulatus and Odonterpeton triangulare are also present, but exceedingly rare. Two additional Linton forms, Molgophis macrurus and Cocytinus gyrinoides, formerly allied to the microsaurs, are presently regarded as members of a yet unspecified lepospondyl order.

Twelve labyrinthodont genera can be recognized from fragmentary remains. Temnospondyl labyrinthodonts include the loxommatids Baphetes lintonensis and Megaloccephalus lineolatus; the edopoids Macrerpeton huxleyi and an undescribed Gaudrya-like edopid; the trimororhachoids Colosteus scutellatus, Erpetosaurus radiatus, and Saurerpeton obtusum; the dissorophid Amphibamus lyelli; and the stegopid Stegops divaricata. Anthracosaur labyrinthodonts are represented by the gephyrostegid Eusauropleura digitata, and two embolomeres, the eogyrinid Leptophractus obsoletus and an undescribed archeriid.

Two reptilian taxa, the captorhinomorph Anthracosaurus longipes and the pelycosaur Archeothyris sp., are represented by isolated skeletal remains.

#### LATE WISCONSIN PRE-MAUMEE I ICE-MARGINAL LAKES IN OHIO: A REQUEST FOR NEW DATA.

Jane L. Forsyth, Geology Department, Bowling Green State University, Bowling Green, Ohio 43403.

2:15

The classic series of ice-dammed lakes in the Maumee basin is well known. So is the extent of glacial ice farther south over Ohio a few thousand years earlier. However, in the in-between time, when the ice had just retreated north of the Ohio Divide in some local areas, small narrow ice-dammed lakes must have developed briefly in many different places along the edge of the glacier.

Examples are the series of small, narrow, very temporary lakes near Lima, in Allen County, at elevations of 850, 825, and 805 feet. These ice-dammed lakes were only recognized after sand deposits mapped by soils scientists were finally recognized as deltas of all three lakes, after which large sand bars in a channel leading into the highest lake and a small gorge forming its outlet in Lima were discovered.

Certainly these are not the only examples of such small, very temporary, ice-marginal lakes in Ohio. Other local ice-dammed lakes oriented parallel to the glacial margin (e.g. not valleys blocked by ice like that of the Cuyahoga River) must have developed at many other places in north-central and northeastern Ohio. Records for such lakes are minimal, so this is a challenge to Ohio's field geologists to look for them and map them, hopefully with the help of soils scientists, so that a more complete picture of the record of scattered late Wisconsin pre-Maumee ice-marginal lakes in Ohio can be assembled.

BOTTOM AND SUBBOTTOM SEDIMENT FROM OHIO WATERS NORTH AND WEST OF WEST SISTER ISLAND, WESTERN LAKE ERIE, AS OBTAINED BY A NEWLY DEVELOPED VIBRATORY CORER; PRELIMINARY RESULTS: Jonathan A. Fuller, Ohio Division of Geological Survey, P.O. Box 650, Sandusky, Ohio 44870

2:30

A 2.4m long, 5cm diameter, ship-based vibratory corer was developed and field tested in conjunction with the U.S. Army Coastal Engineering Research Center. This corer was used to take 85 sediment cores with an average length of 1.6 m. The sediment facies present, based on observation of the top and bottom of the cores, represent glacial and post-glacial depositional environments. The surface sediment near the southern lakeshore consists of a thin lag of sand over a till surface, whereas offshore the surface sediment is dominated by mud, although muddy sand is common along a northwest trending line between West Sister Island and Monroe, Michigan. Sediment from the base of the cores taken west and northwest of West Sister, commonly an area of only partial core penetration, is mostly till west of West Sister, muddy sand or silt along the line between West Sister and Monroe, and silt or clay with minor areas of peat and organic silts further to the north. Sediment from the base of the cores taken northeast of West Sister, commonly an area of total core penetration, is dominated by soft clay or till, except in the area just southwest of Middle Sister Island where sand is found.

DENSIFICATION AND RECRYSTALLIZATION OF FIRN: AN EMPIRICAL APPROACH. Richard B. Alley\*†, Ian M. Whillans\*†, and John Bolzan†, \*Dept. of Geol. and Min. and †Inst. of Polar Studies, Ohio State University, 125 S. Oval Mall, Columbus, Ohio, 43210.

2:45

Densities were obtained from a 50 m firn core from Dome C, central East Antarctica.

Thin sections were prepared on a microtome using dodecane as a filler. Firn was observed to consist of distinct layers. For this study, layers were classified as fine-grained or coarse-grained. Fine-grained layers are probably wind crusts, while coarse-grained firn includes depth hoar, soft snow, and intermediate snow. Crystals in fine-grained layers grow more rapidly with depth than crystals in coarse-grained layers, probably because the smaller crystals have shorter radii of curvature, and thus greater surface free energy. Coarse-grained layers are observed to increase in density more rapidly than fine-grained layers. Based on surface free energies, the opposite behavior would be expected. However, fine-grained firn approximates a closest-packed structure near surface regions, with many crystal-crystal bonds. Coarse-grained firn exhibits a very loose structure, deviating significantly from closest-packing. Thus, load-driven visco-plastic flow and diffusion mechanisms should function more efficiently in coarse-grained firn than in fine-grained firn, leading to more rapid densification of coarse-grained firn. The observed behavior seems to demonstrate the importance of load-driven mechanisms to firn densification.

QUATERNARY STRATIGRAPHY OF FURNACE RUN BASIN, RICHFIELD TOWNSHIP, SUMMIT COUNTY, OHIO. Michael P. Angle and John P. Szabo, Department of Geology, University of Akron, Akron, OH 44325

3:15

The oldest Quaternary deposits exposed in Richfield Township are Early Wisconsinan silts found in the paleovalley of Furnace Run. Hard, dolomitic silty till, tentatively correlated with the Mogadore Till, occurs within the silts. The upper parts of the silts are interbedded with fine sands and are capped by laminated lacustrine clays. The clay generally does not occur above an elevation of 950 feet. Dolomitic sandy Mogadore Till overlies bedrock on the uplands. Olive to dark gray, very calcareous clay till overlies both the silts in the paleovalley and the Mogadore Till on the uplands. The clay till is characterized by olive brown oxidation bands along joints which are found in relief in stream beds. This unit correlates with an unnamed till traced from Northampton Township to the southeast and may have been deposited by a readvance of Mogadore ice over lacustrine silt and clay. Dark brown calcareous Lavery Till is the only Woodfordian till recognized thus far in the township.

PROVENANCE DATES OF FELDSPAR IN GLACIAL DEPOSITS IN THE TRANSANTARCTIC MOUNTAINS. Karen S. Taylor and Gunter Faure, Department of Geology and Mineralogy, The Ohio State University, Columbus, Ohio 43210

3:45

Glacial deposits of widely differing ages from Miocene to Holocene occur at high elevations in the Transantarctic Mountains and along valleys occupied by the major outlet glaciers. The origin of these deposits is the subject of a controversy that affects our understanding of the glacial history of Antarctica in Cenozoic time. Feldspar in the sand-size fractions of several deposits have been dated by the Rb-Sr method in order to determine their provenance. Potential sources of feldspar in these deposits include the granitic basement rocks of the Transantarctic Mountains (500 million years), the Precambrian rocks of the East Antarctic Shield, and arkosic sandstones of the Beacon Supergroup. The results indicate that the feldspar of some glacial deposits on high plateaus was derived from the local basement rocks and that such deposits were probably deposited by local ice caps. Deposits along major valleys contain a component of Precambrian feldspar derived from East Antarctica and were deposited by outlet glaciers draining the ice sheet in the interior.

FELDSPAR FRACTIONATION BY GLACIERS. Gunter Faure and Karen S. Taylor, Department of Geology and Mineralogy, The Ohio State University, Columbus, Ohio 43210.

4:00

Feldspar in the glacial deposits of Ohio and of the Transantarctic Mountains is composed of plagioclase and K-feldspar, primarily microcline. The ratio of K-feldspar to plagioclase increases systematically with increasing grain size in the sand-size fractions. Preliminary evaluation of this phenomenon suggests that the extent of mineralogical differentiation correlates positively with distance of transport. The preferential enrichment of plagioclase in the fine sand fractions cannot be caused by chemical weathering because plagioclase is known to weather more rapidly than K-feldspar especially in small grains. Mixing of fine grained plagioclase with coarse grained K-feldspar is not an attractive explanation either because of the occurrence of fractionation in glacial deposits of both Ohio and Antarctica. The most likely explanation is that plagioclase is ground more rapidly than K-feldspar because of the presence of microfractures that reduce its mechanical strength.

IN-SITU MEASUREMENTS OF LAKE ERIE'S SEDIMENT OXYGEN DEMAND. Wayne S. Davis and Charles E. Herdendorf. Center for Lake Erie Area Research, Ohio State University, 484 West 12th Avenue, Columbus, Ohio 43210.

4:15

Measurements of sediment oxygen demand (SOD) were made throughout Lake Erie in 1978 during August and at two stations (A-1, A-2) in 1979 from June to September. These in-situ batch determinations were conducted with the use of submerged chambers which were lowered to the lake bottom thus sealing in a known volume of water (13.5-16 l) on top of a known surface area of sediment (.186 m). The water was circulated within the chamber and the resultant drop in DO was measured by an electronic probe. The SOD is expressed as gm O<sub>2</sub>/m<sup>2</sup>/day. In 1978, the hypolimnion temperature and the number of benthic macroinvertebrates explain 24% and 22%, respectively, of the variability in the SOD. In 1979, the dissolved oxygen content in the hypolimnion accounted for 64% of the SOD variability. SOD values in this investigation range from .10 gm O<sub>2</sub>/m<sup>2</sup>/day - 3.19 gm O<sub>2</sub>/m<sup>2</sup>/day. The mean SOD for the western, central, and eastern basins in 1978 were 2.44, 1.14, and 1.35 gm O<sub>2</sub>/m<sup>2</sup>/day, respectively, at their ambient temperatures. The mean SOD for the summer of 1979 was 0.99 gm O<sub>2</sub>/m<sup>2</sup>/day with a strong trend indicating a decrease in SOD throughout the summer apparently due to limited oxygen availability.

## C. GEOLOGY

SECOND AFTERNOON SESSION

202 SCOVEL HALL

EDWIN T. ASHWORTH, PRESIDING

RELATIONSHIP OF GEOLOGY TO COAL FRACTURE TRENDS AND PALEOSTRESS FIELDS IN WEST VIRGINIA. Dean, Stuart L., Department of Geology, University of Toledo, Toledo, Ohio 43606; Kulander, Byron R., Department of Geological Sciences, Wright State University, Dayton, Ohio 45435.

1:30

Systematic coal fracture trends (face cleat) maintain unique orientations over large areas in West Virginia. These fracture trends delineate distinct fracture domains. Furthermore, intervening domain boundaries are sharply defined. Domain boundaries can separate fracture domains, each characterized by singular but different fracture trends. Boundaries can also delineate regions characterized by more than one fracture trend, some of which may be common to several domains. Here, the trend of the dominant fracture set in one domain differs from the dominant set trend in adjacent domains. Six fracture domains are evident in West Virginia. In every case, coal fractures were the result of brittle failure and formed in response to the greatest principal effective tension that acted perpendicular to any advancing fracture front. Failure occurred in response to stress systems which were active during the coal maturation process. These stress systems were unique to each domain. Therefore fracture domains reflect paleostress domains. It follows that several fracture trends within a domain indicate changing stress fields through time. Finally, spatial relationships suggest that fracturing stresses within domains have been influenced by 1) Precambrian basement structure and regional basement configuration, 2) contrasting mechanical response of sedimentary columns within the northern and southern coal basins of West Virginia, 3) down to the basin faults in the rapidly subsiding southern coal basin, 4) lateral stresses associated with the Alleghenian orogeny.



ACCEPTABLE QUALITY MINE DRAINAGE FROM SURFACE BITUMINOUS COAL MINING IN EAST CENTRAL OHIO. Robert G. Corbett and Barbara M. Manner, Department of Geology, The University of Akron, Akron, Ohio 44325

1:45

We monitored major and selected trace elements in drainage from an active surface mine in the Middle Kittanning Coal for more than one year. The location is at the western edge of the Appalachian coal basin, where overburden and coal tend to be high in sulfur, a situation which ordinarily results in acid mine drainage. A reference stream and the outflow from a settling pond which collected most of the drainage from the workings were sampled twice monthly. All our data show that both the reference stream and settling pond outflow tend to be calcium-sulfate type water.

The characteristics commonly ascribed to acid mine drainage include low pH and high iron, aluminum, and sulfate content. Hill, 1968, has classed mine drainage into four types, depending upon values for those parameters. Both the reference stream and the outflow from the settling pond are "oxidized and neutralized and/or alkaline" (Hill's "Class 3"), based upon ranges of pH, iron, aluminum, and sulfate of 6.31-8.30, 0.23-3.9 mg/l, 0.1-4.4, 16-750 (reference stream) and 6.42-8.12, .05-1.3 mg/l, .01-3.2, 52-1000 (outflow).

This relatively good quality drainage results from the influence of a zone of calcite cement in the overlying Upper Freeport Sandstone which provides sufficient neutralization capacity to overcome the potential for production of acid mine drainage from the Middle Kittanning Coal and overlying Lower Freeport Shale (Bogner and Others, 1979).

This project was supported by Argonne National Laboratory.

ROCK PHOSPHATE/LIME NEUTRALIZATION OF COAL ACID MINE DRAINAGE

2:00

Brent E. Huntsman and David M. Haile, Departments of Environmental Studies, Brehm Environmental Laboratory, Wright State University, Dayton, Ohio 45435 and Monsanto Research Corporation, Dayton, Ohio 45418

Utilizing the U.S. Environmental Protection Agency's (USEPA) Crown Mine Drainage Control Field Site facility, an application of rock phosphate (fluorapatite) filters was investigated. These filters were constructed and installed at the inflow of the treatment facility receiving coal acid mine drainage from a deep-shaft mine complex. The study established a workable phosphate-lime neutralization process which could be adapted to existing coal mine drainage treatment plants. A summary of the data obtained and an overview of the process will be presented.

ENVIRONMENTAL GEOLOGY IN THE FIELD IN SOUTHEASTERN OHIO

Utgard, R. O. and McKenzie, G. D., Department of Geology and Mineralogy, Ohio State University, Columbus, Ohio 43210

2:30

In Southeastern Ohio ideal situations for teaching environmental geology are to be found on field trips suitable for college and high-school students. For the main topics of environmental geology--resource utilization, geologic hazards, and environmental quality--there are numerous sites that can provide information and experience. The environmental impacts that must be considered with the extraction of coal, oil, limestone, and sand and gravel are apparent at active sites. In the case of coal, the contrast between new and old reclamation techniques illustrates the loss of resources associated with environmental degradation both off- and on-site. The sociological impact of poor land and resource management in the past may also be discovered. Two power plants provide testimony to the importance of advanced technology in our society and a comparison of these two plants illustrates our technological progress in energy use and environmental protection.

The effects of floods, landslides, in both mined and unmined areas, and subsidence due to coal extraction are apparent in this area. The costs of these and other geological hazards, which in some cases have been induced by man, are a reminder of the importance of understanding geologic processes. Landfills reveal the need for recycling of our misplaced resources.

2:45 THE AFFECT OF GEOMORPHOLOGY ON WEATHER OCCURRENCES IN THE NORTHCENTRAL OHIO HIGHLANDS. Bernard R. Henniger, Geology Dept. Ashland College, Ashland, Ohio 44805

The Northcentral Ohio Highlands is defined by a circular to ovoid line extending from Lodi, Ohio through New London, Willard, Bucyrus, a point halfway between Galion and Marion, and a point approximately 5 miles north of Mount Vernon, Ohio. This topographic highland lies at the north end of the Mississippian and Pennsylvanian age strata which outcrop prominently near Loudonville, Ohio in a high topographic escarpment on the western edge of the Appalachian Plateau.

The Wabash end moraine enters the state on the west in central Mercer County and extends eastward to central Marion County. From there, it curves northward to central Crawford County, then curves in an arcuate pattern to the east through northern Richland and Ashland Counties, to eventually join the Defiance and Spencer end moraines near Medina, Ohio. This juncture of topographically high end moraines is what produces the well-known "Secondary Snow Belt" of north-central Ohio.

This topographically high morainal ridge on the north, when combined with the Appalachian Plateau escarpment on the east, produces a funneling effect for the normal northeasterly storm tracks originating in southwestern and western Ohio. The resulting storms are then forced to rise over the Northcentral Ohio Highlands, producing strong orographic effects.

3:00 ANALYSIS OF ROCK AND SOIL SAMPLES BY INSTRUMENTAL METHOD NEUTRON ACTIVATION ANALYSIS. Joseph W. Talnagi, Jr. The Ohio State University, Nuclear Reactor Laboratory, 1298 Kinnear Road, Columbus, Ohio, 43212.

Instrumental Method Neutron Activation Analysis (INAA) is a standard technique used in geochemical analysis. The INAA program at The Ohio State University has been active for several years. The primary participants are members of the Department of Geology and Mineralogy, The Institute of Polar Studies, and the staff of the OSU Reactor Laboratory. Analysis techniques used and representative results obtained for several U.S.G.S. standard rocks are presented and discussed. Results for an analysis of soil material provided by the International Atomic Energy Agency are also reviewed. The results show good agreement with published values and results of other studies. Recommendations for continued study are also presented.

3:30 LATE MISSISSIPPIAN AND PENNSYLVANIAN PALEOGEOGRAPHY AND TECTONICS OF THE BIRD SPRING GROUP, CLARK COUNTY, NEVADA. Michael Rendina, The College of Wooster, Wooster, Ohio 44691 and Mark A. Wilson, University of California, Berkeley, California 94720.

Parts of the Antler Positive Element of central Nevada remained emergent during most of the Pennsylvanian Period. However, the southernmost section, which had formed a barrier between an eastern and western seaway in southern California during Chesterian and earliest Morrowan time, was submerged sometime during the Morrowan Epoch. Sediments deposited on this platform are well represented by the Indian Springs Member of the Bird Spring Formation, which outcrops in the Spring Mountains of western Clark County, Nevada. The Indian Springs consists predominately of gray to black shale, thin bioclastic limestones, and clean orthoquartzites. The lower boundary is paraconformable with the top of the Monte Cristo Limestone. The upper boundary of this section is marked by the occurrence of cherty limestone beds.

Petrographic examination of samples collected from eight sections in western Clark County indicates that the Indian Springs sediments accumulated in shallow water, nearshore to supratidal conditions. These results are consistent with the hypothesis that the southern prong of the Antler Positive Element was relatively subdued at this time.

PETROLOGY OF THE MUDROCKS OF THE DUNKARD GROUP (UPPER PENN-  
SYLVANIAN-PERMIAN) NORTHERN DUNKARD BASIN, WEST VIRGINIA AND  
PENNSYLVANIA. Mark A. Thomsen and Dr. Wayne D. Martin, Department of  
Geology, Miami University, Oxford, Ohio 45056.

3:45

The Dunkard Group, which consists of clastic and nonclastic rocks, outcrops in an area of elliptical shape in eastern OH, southwestern PA, and northern W.Va. Fine grained terrigenous rocks make up approximately two-thirds of the rock sequence. The sediments from which these rocks were formed were largely deposited in a fluvial-paludal complex of laterally shifting environments.

Samples of mudrocks collected from the northern third of the area of Dunkard Group outcrop were studied to determine the particle size distribution and mineral content. The average sample contains approximately 3% sand, 50% silt, and 47% clay. A mineralogical study based primarily on X-ray diffraction data reveals a nonclay fraction composed primarily of quartz, potassium and plagioclase feldspar, pyrite, and calcite. All of the clay fractions of the mudrocks contain illite, kaolinite, and mixed-layer material. Chlorite and vermiculite occur in some of the samples studied. It is suggested that the great majority of clay minerals in the samples studied are detrital in origin and strongly reflect the character of the source material. Diagenetic processes have contributed only slightly to the clay mineral suite.

STABILIZATION OF ABANDONED DEEP MINES. Ann G. Harris, Department of Geology,  
Youngstown State University, 410 Wick Avenue, Youngstown, Ohio 44455

4:15

In the Youngstown, Ohio area abandoned deep mines, most of them over 100 years old, are beginning to collapse or open up. In as much as they create a danger to public health and safety, they must be stabilized. The shafts are dug out below the level of the cribbing with a clam bucket to a point where the cribbing is good. They are filled with slag or equivalent material to the top of the cribbing. A reinforced concrete slab is poured on top of the cribbing, extending at least three feet beyond its perimeter. A hollow PVC pipe had previously been inserted through the cap and extended to the surface of the ground. This is to be used as an observation port to see if the fill material is withdrawing from the cap. It can be used to add additional material if necessary.

To seal off drift or slope entries a pneumatic method of blowing in material and filling in the entrance at least 25 feet back is being used.

## D. MEDICAL SCIENCES

FIRST MORNING SESSION

601 MATEER HALL

JOSEPH ZAMBERNARD, PRESIDING

BLOOD AND HEART RATE CHANGES IN MALLARDS (ANAS PLATYPHYNCHAS) EXERCISED AT HIGH ALTITUDES. Elden W. Martin, Dept. of Biological Sciences, Bowling Green State University  
Bowling Green, OH 43403.

9:00

Catheters were surgically implanted in a wing artery and vein of anesthetized adult Mallards the day before experimentation. Silver electrodes for electrocardiography were placed subcutaneously at the time of surgery and leads were attached to a dorsal surface connector. Recovery time was spent in an exercise box inside an altitude chamber where food and water were available. Arterial and venous blood samples were drawn and the ECG recorded before and after exercise on a treadmill, at ambient pressure and at reduced pressures simulating 5,000, 10,000 and 15,000 ft altitude. Partial pressures of oxygen ( $P_{O_2}$ ) and carbon dioxide ( $P_{CO_2}$ ) and pH of blood were measured immediately after samples were drawn. Hematocrit and blood glucose values were determined for each sample. Heart rates were significantly higher after exercise than before, but rates under both conditions were highest at 5,000 and 15,000 ft. Hematocrit values did not vary appreciably with altitude or exercise. Blood pH increased proportionately with altitude. Post-exercise blood had a consistently lower pH than pre-exercise blood at pressures below ambient.  $P_{O_2}$  and  $P_{CO_2}$  in both arterial and venous blood declined as altitude increased. Exercise had no large effect on  $P_{O_2}$  or  $P_{CO_2}$  although post-exercise arterial  $P_{O_2}$  was consistently higher with an increased difference at 10,000 and 15,000 ft. Implications of these data regarding normal flight will be discussed.

THE EFFECTS OF AIR POLLUTION ON PULMONARY FUNCTIONS OF AKRON AREA ADOLESCENTS: A LONGITUDINAL STUDY. Fawcett, S., Mostardi, R.A., Ely, D.L., and Conlon, M., Department of Biology, The University of Akron, Akron, OH 44325.

9:15

Pulmonary and questionnaire data of children from two Akron grade schools were compared in a three year study. One school was located in a relatively low pollution area and the other in a high pollution area. Air pollution monitoring stations were set up at each school which monitored  $SO_2$ ,  $NO_2$  and total suspended particulates. Pulmonary functions of the children, included forced expiratory volume, forced vital capacity, and maximal midexpiratory flow. Questionnaire information was gathered each year concerning the respiratory history and any current symptoms of the subjects. The questionnaire responses were tabulated as individual question responses and as syndromes.  $SO_2$  was more than 3x higher and  $NO_2$  almost 1.5x higher in the more polluted area and these children had significantly higher incidence of "cough with no cold", "productive cough", "wheezing chest", and "shortness of breath with wheezing" than children in the less polluted area. Shortness of Breath Syndrome occurred 6x more often and Cough Phlegm Syndrome 4.5x more often in children in the more polluted location. Lung functions were not significantly different between the children from the two schools. (Supported by USEPA 804256-01, 02).

THE TERATOGENIC EFFECTS OF CARBAMAZEPINE (CMZ) IN THE CD-1 MOUSE FETUS. Fabian O. Eluma, Martha E. Sucheston, Thomas G. Hayes and Ruth Paulson. Department of Anatomy, The Ohio State University, Columbus, Ohio, 43210.

9:30

The anticonvulsant drugs used in the treatment of epilepsy have been identified as potential teratogenic agents. The objective of this study was to determine the teratological effects of carbamazepine in CD-1 mouse embryos: its dose-response relations, its formation of gross external and skeletal defects, and its effect on fetal growth. Adult CD-1 pregnant mice on days 7-12 of gestation received carbamazepine at dose levels of 375mg/kg, 563mg/kg and 938mg/kg. In addition a treated and untreated control group were maintained. On day 17 of gestation all pregnant mice were sacrificed and uterine implantation sites were counted and recorded as live, dead or resorbed. Each live fetus was examined for external gross and skeletal defects. The results were analyzed by the Chi Square Test of Independence, the analysis of covariance and the log-linear analysis. Examination of 1099 CD-1 mouse fetuses showed carbamazepine at these three dosage levels to be teratogenic and fetotoxic. There was a dose-related increase in dead and resorbed fetuses, but not in fetal weights. The external gross malformation frequency was dose related, increasing from 9.4% in the untreated control to 51.4% in the 938mg/kg treatment group. On a pooled percentage basis 11.6% of all fetuses showed skeletal defects. The uterine horn position of the defects produced by CMZ ingestion showed that the dead fetuses were more often found at the distal end of the horn, the resorbed fetuses in the middle of the horn, and the pale fetuses at the ovarian end of the horn, while the remaining defects were randomly scattered throughout the uterus.

PROPHYLACTIC EFFECT OF PURIFIED BOVINE LECITHIN ON STAPHYLOCOCCUS AUREUS INFECTIONS IN SWISS ALBINO MICE.

9:45

M. C. Sower, L. G. Nutini, Y. Tsuchiya, and M. L. Kabongo-Muamba. St. Thomas Institute, Cincinnati, Ohio 45206

Alternative treatments of staphylococcal infections are currently being explored because of the emergence of antibiotic-resistant strains of Staphylococcus aureus. In our investigations we have found that prophylactic treatment with a purified bovine lecithin (PBL) will markedly reduce death in mice due to systemic staphylococcal infections. Fifty mg of PBL was injected intraperitoneally in different groups of mice at 24, 48, 72 hours, and 7 days prior to intraperitoneal challenge of each group with  $2.5 \times 10^7$  organisms. On the average, a 10% mortality was observed in the experimental groups as compared to a 60% mortality in the untreated control groups. The data suggest an optimum time for administration of the PBL to be 48 hours prior to staphylococcal infection, but PBL affords protection when given as early as 7 days before infection. Therefore, when given prophylactically, the PBL confers upon the animal a protection against death due to S. aureus infection.

PLACENTAL PERFUSION: A MODIFICATION OF PREVIOUS DESIGN. P. D. Beckley, B.S. and K. M. Hanson, PhD. Division of Circulation Technology and Department of Physiology, The Ohio State University College of Medicine, Columbus, Ohio 43210

10:00

A brief introduction includes a listing of previous and potential applications of placental perfusion as well as historical comments regarding previous apparatus design. The device which we have designed and built is shown. We believe that our apparatus contains important differences from those of previous investigators. These differences primarily involve the method with which the device perfuses the intervillous space of the placenta and thus mimics the maternal blood supply. These modifications and resulting advantages over previous devices are discussed. An outline of the technique of placental acquisition and methods of initiating placental perfusion are presented. The capability of establishing a dual circulation (maternal and fetal) is, of course, a key advantage to this apparatus. Methods of verifying the true separation of circulations and the integrity of the device are outlined. These methods include (1) observing the responsiveness of the fetal circulation to a variety of pharmacological agents and gas mixtures, (2) perfusion of fluorescein dye with subsequent analysis of the placental tissue under ultraviolet light, (3) calculation of oxygen consumption by the placenta and (4) calculation of the transfer rates of glucose, amino acids, urea and creatinine. (We gratefully acknowledge financial support from the Department of Obstetrics and Gynecology of The Ohio State University Hospitals.)

EFFECTS OF DIETARY IRON AND PARENTERAL IRON DEXTRAN ON IRON HISTOCHEMISTRY IN THE GUT OF THE RAT. George Jonson and David Morton, Department of Biological Sciences, Wright State University, Dayton, OH 45435

10:15

Recently, one of us reported large amounts of histochemically reactive iron in the gastrointestinal tract of the sanguivorous common vampire bat. Macrophage-linked iron clearance through this route may be crucial to maintaining iron balance in this animal. In order to determine whether elements of a similar mechanism are present in the rat, fifteen male weanlings were injected intraperitoneally with 1 ml of iron dextran complex containing 50 mg of Fe. Three groups of five rats each along with an equal number of non-injected animals were raised on either low Fe (20 ppm), normal Fe (220 ppm) or high Fe (500 ppm) diets. Rats were sacrificed after three weeks and pieces of various organs were embedded in glycol methacrylate. Sections of these organs were treated with Prussian blue reaction for iron. In the uninjected rats, increased dietary iron was preferentially deposited in the colons and spleens compared to none or little in the cardiac stomachs, duodena, ilea, livers or lungs. In comparison, all of the above organs of the injected rats had increased amounts of iron although the levels in those from animals fed the low iron diet were consistently slightly lower. In addition, iron in the injected rats was especially prominent both in and around intestinal lymphatic nodules. At the cellular level, gastrointestinal iron was located primarily in siderotic macrophages in the connective tissues, and in the apical cytoplasm of mucosal epithelial cells. The pattern of iron histochemistry in the intestine of the parenterally iron overloaded rat was essentially the same as that in the common vampire bat.

THE DISPOSITION OF Pb, Hg AND Cd IN MATERNAL BLOOD, FETAL CORD BLOOD, AND PLACENTAL TISSUES. P.M. Kuhnert, B.R. Kuhnert. Perinatal Clinical Research Center, Case Western Reserve University, 3395 Scranton Road, Cleveland, Ohio, 44109.

10:30

Sporadic outbreaks of heavy metal poisoning have occurred throughout the world and have involved pregnant women and newborn infants. Questions have naturally arisen concerning the transport and distribution of these metals in the maternal-fetoplacental unit. The purpose of this investigation was to determine the distribution of lead (Pb), mercury (Hg), and cadmium (Cd) in maternal and fetal cord blood, and in the placenta of a "normally" exposed human population. From our data it is clear that higher levels of lead are found in maternal erythrocytes than in fetal erythrocytes, and that the levels correlate well. In contrast, higher levels of methyl mercury were found in fetal erythrocytes than in maternal erythrocytes, and that these levels also correlate well. The Cd levels were found to be low in both maternal and fetal cord blood. In regard to the placenta, it appears to act as a partial barrier for Pb, inorganic Hg and Cd, but not for methyl mercury. These results indicate that for a given level of exposure of the pregnant woman to Pb, inorganic Hg, and Cd, the fetus is exposed less; but in the case of methyl mercury, the fetus is exposed more.

AN ASSAY OF TYLOSIN TARTRATE LEVELS IN TURKEY EMBRYO TISSUE FROM DAY TEN TO HATCH.  
Shearer, T.S.; Reiter, C.M.; and Frey, J.R. Natural Systems Studies Department,  
The Defiance College, Defiance, Ohio 43512.

10:45

It is common practice for commercial hatcheries to dip fertilized turkey eggs in antibiotic solutions of tylosin tartrate to control infections of Mycoplasma melagridis. Fertilized turkey eggs dipped in tylosin tartrate solution prior to incubation were obtained from a commercial hatchery, and tissue samples were aseptically taken from developing embryos and poult on day ten of incubation to hatch. Control tissue samples were obtained from embryos developed in eggs not dipped in the tylosin tartrate solution prior to incubation. All tissue samples were tested for tylosin tartrate levels using the cylinder plate method (ATQ) described by Cavanagh (1963) using Micrococcus luteus (ATCC #9341). The tissue samples from the non-dipped eggs proved to be negative for the presence of tylosin tartrate. Embryo and poult tissue samples taken from those eggs dipped in the antibiotic prior to incubation demonstrated the presence of varying levels of tylosin tartrate. The results and the relationship between tylosin tartrate levels as related to embryo development and tissue samples obtained from hatched poult will be presented.

## D. MEDICAL SCIENCES

FIRST AFTERNOON SESSION

GO1 MATEER HALL

JOSEPH ZAMBERNARD, PRESIDING

### IN VIVO ACNE PATHOGENESIS.

Martin L. Kabongo-Muamba and Leo G. Nutini. St. Thomas Institute,  
Cincinnati, Ohio 45206

1:30

To understand the pathogenesis and succeed in treatment of acne vulgaris, sound in vivo animal studies are required. The successful establishment of such an experimental animal model for acne pathogenesis is presented, using young and old rabbits. Intradermal injections of suspensions of  $2.0 \times 10^9$  to  $6.0 \times 10^{10}$  cells of Propionibacterium acnes produced inflammatory papules and nodules (4 to 10 mm) suggesting closed and open comedones that remained up to 8 weeks. The injection of a suspension of a 50:50 mixture of P. acnes and Staphylococcus aureus produced nodules that became pustules and open comedones in 3 to 20 days. The intradermal inflammatory reaction and erythematous flares (5 to 15 mm in diameter) were characterized by no increase in the total white blood count, erythrocyte sedimentation rate, or in the titer of C-reactive protein. There was a definite and specific shift in the peripheral blood differential leukocyte count (27 to 59% granulocyte increase) and a significant 4 to 10 fold increase of rabbit serum P. acnes agglutinin titer. The data support the synergy of P. acnes and a pyogenic Gram-positive organism in the pathogenesis of this disease.

### THE EFFECTS OF AMBIENT AIR POLLUTION EXPOSURE ON BALB/C/KI MICE.

Masaryk, J.T., Mostardi, R.A., Ely, D.L., and Youssefi, M., Department  
of Biology, The University of Akron, Akron, OH 44325.

1:45

Balb/c/Ki mice were exposed to four Ohio environments which differed in ambient pollution. The four environments were highly industrialized Akron and Cleveland, lowly industrialized Elyria, and a control group in Rootstown. Female mice were bred and disseminated to each area and gave birth 3 weeks later and the newborns were weaned, separated by sex, and housed six to a box in standard mouse cages (20x25 cm). The mice were protected by a large slant roof shelter (137x140x51 cm, 127 cm above ground). Food, water, and maintenance were uniform for all groups. After three months and six months of exposure selected mice from each of the sites were weighed and exsanguinated. Their hair, livers, and lungs were collected. Histological examination of liver and lung tissues revealed no differences in mice exposed to different environments for three or six months. Atomic absorption spectroscopy of blood and hair showed significant differences in arsenic, cadmium, lead and mercury levels among the animals according to location and age. Aryl Hydrocarbon Hydroxylase levels in lung tissue was measured by a Perkin Elmer 512 Fluorometer indirectly and found to vary according to the location in the three month mice. (Supported by USEPA 804256-01, 02)

2:00

White Leghorn cockerels, 21 days post-hatch, were anesthetized and their right tibio-tarsometatarsal joint (T-TM) was surgically exposed to allow a 1" deep dental drill damage between the intercondylar surface and marrow cavity of the distal tibia. Following 24 h recovery period 40 animals were maintained at earth gravity (1G) and 40 under (2G) conditions by chronic centrifugation. Half of the 1G (20) and half of the 2G (20) animals were injected (at 21, 24, 28 and 34 days post-hatch) into the right T-TM joint with 0.2 ml of 0.06 M Acetic Acid (HAc) while the remaining 1G and 2G animals received intracapsular injections with 0.2 mg porcine growth hormone (p-STH) dissolved in 0.2 ml of 0.06 M HAc. Animals were sacrificed by decapitation (10 per group) at 8 and 15 days after the onset of the experimental period. The injured limb was resected and processed histologically for ocular micrometer readings of the gap area and for the height and width of the new cartilage formation within the distal tibia deficiency. Compared to 1G controls all 8 days experimental animals showed a significant growth in width of the gap area cartilage. The height of the new cartilage was significantly increased by the 8th day when the 2G animal was supplemented with p-STH. Growth in width and height of the gap area cartilage was significantly increased by the p-STH treatment by the 15th experimental day under both 1 and 2G conditions. Compared to 1G controls, animal exposure, for 15 days, to the 2G environment without a p-STH treatment inhibited growth in height and width of the gap area cartilage.

#### RaVe TUMOR: MITOCHONDRIAL ALTERATIONS.

Michael W. Tindal, Robert T. Heath, and Raymond M. Gesinski.

Dept. of Biological Sciences, Kent State University, Kent, Ohio 44242.

2:15

The RaVe tumor is a rapidly growing, highly metastatic murine lymphoma which kills its host in 8-10 days. Studies of energy flow in this tumor have demonstrated alterations in mitochondrial structure and function when compared to normal liver mitochondria. Tumor mitochondria isolated in the presence of bovine serum albumin (BSA) and assayed for oxygen consumption and P/O ratios in the presence of BSA exhibit significantly lower P/O ratios than those of normal liver mitochondria (0.6 and 1.7 respectively). Both RaVe tumor mitochondria and normal liver mitochondria exhibit respiratory control ratios (RCR) within the same range (2.0-2.6). Tumor mitochondria assayed in the absence of BSA demonstrate no RCR while normal liver mitochondria demonstrate RCR within a range of 1.4-1.8. These functional alterations of RaVe tumor suggest structural alterations of the inner mitochondrial membrane rendering this membrane more permeable (leaky) to hydrogen ions than the inner mitochondrial membrane of normal liver. Tumor mitochondria also exhibit an alteration in electron transport cytochromes as determined by reduced minus oxidized difference spectra. This alteration is believed to be a factor responsible for a stimulation of oxygen consumption rates of tumor mitochondrial nonphosphorylating electron transport particles when compared to those of normal liver (125-282 and 22-37 nM  $O_2$  consumed/min/mg protein respectively).

#### REDUCTION OF RESPIRATORY SYNCYTIAL VIRUS INFECTIVITY BY A PURIFIED BOVINE LECITHIN IN HEP-2 CELLS.

2:30

M. C. Sower, G. Mbuy, L. G. Nutini, and Y. Tsuchiya. St. Thomas Institute, Cincinnati, Ohio 45206 and The Christ Hospital Institute for Medical Research, Cincinnati, Ohio 45219.

Infectivity of respiratory syncytial virus (RSV), assayed by the plaque-reduction method, was found to be markedly reduced by the addition of a purified bovine lecithin (BPL) before and after viral infection. Hep-2 cells were grown to 85-90% confluency. Group 1 received 250  $\mu$ g/ml PBL in standard medium 24 hours before viral infection. Group 2 received the same pretreatment with PBL but also received a second treatment with 250  $\mu$ g/ml of PBL after infection. Group 3 was treated with PBL only after infection. Control Group 4 was untreated. In all groups after 24 hours cell monolayers were washed and infected with RSV. The plates were incubated until the cell monolayers were completely destroyed. The supernatants of each group were pooled and titered on Hep-2 cells for plaque-forming virus. Group 1 showed a 50% reduction in plaque-forming units (pfu/ml) as compared with the control. Group 2 showed a 97% reduction in pfu/ml, while Group 3 showed an 85% reduction. Thus PBL was effective when added to Hep-2 cells either before or after infection with RSV but was most effective when given both before and after infection.

POSSIBLE ROLE FOR LYMPHATIC NODULES IN INTESTINAL IRON CLEARANCE. David Morton, George Jonson, and Bruce G. Chin, Department of Biological Sciences, Wright State University, Dayton, Ohio 45435

2:45

Iron, as demonstrated by the Prussian blue (PB) reaction, has been studied in histological sections of lymphatic nodule containing regions of the intestine.

The two animals used in this study are the common vampire bat (Desmodus rotundus), a mammal normally on a high iron diet, and the rat. The latter was made iron replete with intraperitoneal injection of iron dextran complex. In the intestines of both species siderotic macrophages are concentrated both in and around lymphatic nodules. Such cells are present in germinal centers as well as in the surrounding dense and loose lymphatic tissues. Siderotic macrophages near the middle of germinal centers tend to have diffuse PB staining cytoplasm. However, as they are more peripherally situated cytoplasmic staining is more intense and is primarily confined to large, irregularly shaped granules. In autoradiograms of bats administered <sup>55</sup>Fe intraperitoneally, the number of silver grains over these cells is higher the further they are located from the middle of the germinal center. In the mucosa of both species, groups of siderotic macrophages are associated with patches of PB-positive epithelial cells. Iron is lost from the body as epithelial cells are shed into the lumen. Moreover, in the rat but never in the bat, siderotic macrophages are observed between these cells. It is proposed that intestinal lymphatic nodules are depots and perhaps sources for siderotic macrophages involved in iron clearance through the gut.

HYPERGRAVITY INDUCED CHANGES IN THE MOUSE THYMUS. Jeffrey A. Greenberg and Kenneth Jones, Department of Anatomy, The Ohio State University, College of Medicine, Columbus, Ohio 43210

3:00

Stress related involution of the thymus in mice has been established. Previous reports illustrate thymic involution with administration of corticosteroids along with natural involution associated with pregnancy and aging. In this report the effect of hypergravitational stress on the adult thymus was studied.

Six week old female mice (Swiss) were centrifuged at 2g. Additional mice were rotated at 22 rpm at 1g while control mice were kept stationary. Data indicate significant differences in thymus weights between 2g and control mice. No significant differences were found between 2g and 1g or 1g and control mice. Thymus weight was at a minimum at day 2 for both 2g and 1g mice, gradually recovering to control weight levels at day 8. Spleen weights showed significant differences at days 1 and 2 for all groups. There were no significant differences in body weights.

Microscopic analysis indicates a dramatic change in the thymuses of the 2g mice. Unlike control and 1g mice which had a well developed cortex, the 2g animals had a very thin, sparse cortex. At days 4 and 8 the 2g animals show some cortex recovery, returning to the control type of cortex.

#### PROBIOTIC NON-ANTIGENIC TUMOR FRACTIONS IN CANCER CONTROL.

Leo G. Nutini, John C. Fardon, Alejandro G. Duarte, George S. Sperti, J. Freidel St. Thomas Institute, Cincinnati, OH 45206

3:15

Probiotics, non-antigenic cellular fractions, have proven significantly effective, where tested, in controlling bacterial and viral infections in laboratory animals. As a consequence of success on bacteria and viruses, tumor results with probiotics have been re-examined and the tumor work extended with new significant results.

Probiotics injected intravenously have proven significantly effective in preventing the development of tumors in and death of an inbred strain of mice, DBA/1. The control and treated groups were challenged intravenously with 500,000 viable dBrB cells and subsequent subcutaneous inoculations with equal numbers of cells. In the control group 100% mortality resulted from lung tumors, while in the experimental 20%. In the experimental group 53% developed subcutaneous challenge tumors and 47% neither lung nor challenge tumors.

When C3H/Jax mice were treated intravenously with a non-antigenic fraction of C3H/Jax tumor, 85% deaths, due to spontaneous mammary tumors, resulted in the control group as compared with 45% in the treated group.

In a previously reported test on a variety of human epitheliomas, non-antigenic fractions were injected intracutaneously in and around the tumor areas. The fraction gave significant results in which 37 of 50 humans (or 77%) treated had no recurrence at the end of a 5-year period.



## THE EFFECT OF CYCLOPHOSPHAMIDE ALONE AND IN COMBINATION WITH PCO ON BDF<sub>1</sub> MICE BEARING L1210 TUMOR

3:30

David Williamson, Timothy Schroeder, and Leo G. Nutini  
St. Thomas Institute, Cincinnati, OH 45206

An alcohol-deproteinized yeast extract, termed PCO (Pro-cyt-oxid) was studied for its effect in offsetting the toxicity of cyclophosphamide and increasing the life span of tumor-bearing mice (BDF<sub>1</sub> mice, L1210 tumor) treated with this drug. Administration of PCO alone showed no effect on increasing the life span of the leukemic mice, but varying doses of cyclophosphamide alone and in combination with PCO demonstrated definite beneficial effects which were dose related. Both intraperitoneal and subcutaneous injections of each drug were investigated, and there was a more marked degree of protection against toxic manifestation of cyclophosphamide when it was injected subcutaneously in combination with PCO.

Intraperitoneal treatments with combined therapy, although not as effective as subcutaneous injections, showed an increase in life span over those tumor animals receiving cyclophosphamide alone.

Experiments initiated prior to the tumor experiments, using cyclophosphamide to induce leukopenia and illustrating the ability of PCO to offset this effect in random-bred mice (BT) and rabbits will also be discussed.

THE EFFECT OF EXOGENOUS SODIUM CHLORITE ADMINISTERED IN-OVO ON THE VIABILITY OF THE CHICK EMBRYO. John Delphia, Daniel Couri and Elsayed Ammar. Departments of Anatomy and Pharmacology, College of Medicine, Ohio State University, Columbus, Ohio

3:45

Sodium chlorite ( $\text{NaClO}_2$ ) can be employed as a disinfectant of drinking water. The effects of this substance on embryonic development have not been reported. The present study is concerned with the effect of  $\text{NaClO}_2$  administered in-ovo on the viability of the chick embryo. Fertile White Leghorn chicken eggs were incubated at 100° F and 64% relative humidity in a rotary incubator.  $\text{NaClO}_2$  was administered in one of the following volumes of sterile distilled HOH: 20, 50 or 100  $\mu$  liters. Single doses of  $\text{NaClO}_2$  were administered; dosages ranged between 1.0 and 100.0  $\mu$  grams/egg. Controls received one of the three volumes of sterile distilled HOH. The time of treatment was: 0, 48 or 96 hours of incubation. Specimens were collected at 5, 7 or 9 days of incubation and at hatching.

$\text{NaClO}_2$  increased the rate of mortality significantly ( $P < 0.05$  or greater using Chi Square method) in a dose-dependent fashion in all volume groups (20, 50 or 100  $\mu$  liters sterile HOH) and in all time groups (treatment at 0, 48 or 96 hours of incubation). The lowest dosage of  $\text{NaClO}_2$  in all time-groups which produced an increased mortality was 25  $\mu$  grams.

4:00 BUSINESS MEETING

## E. PHYSICS & ASTRONOMY

FIRST MORNING SESSION

101 TAYLOR HALL

EDWARD S. FOSTER, JR., PRESIDING

DETERMINATION OF THE STRESS INTENSITY FACTORS OF A SYSTEM OF CRACKED PLATES WITH VARIOUS CRACK GEOMETRY AND LOADING CONDITION. Bahram Farahmand & Demetrios D. Raftopoulos; Department of Mechanical Engineering, The University of Toledo, 2801 W. Bancroft; Toledo, Ohio 43606.

9:00

An attractive method that was considered experimental and theoretical in nature is presented herein to investigate the stress intensity factors of cracked plates with simple and complicated crack arrangements. The experimental setup is simply a monochromatic collimated light beam from a He-Ne laser of 6378A wavelength which is directed at the locality of the tip of the crack under investigation. In brief, due to the existence of a highly stressed region surrounding the crack tip, the refractive index and the thickness of the specimen change considerable and, hence, the incoming beam will deviate. The pattern that was received on a screen was examined and it was utilized in order to investigate the stress intensity factors. First, for cracks of simple configuration, a function was developed which behaved as the theoretical stress intensity factor. This function was employed to investigate more complicated crack arrangements, such as, a system of equal and unequal normal periodic edge cracks subjected to tension, and equal and unequal parallel and symmetric edge cracks subjected to pure bending. The method was further extended to study angled edge cracks of various angle and under tension. For equal and unequal normal parallel edge cracks and equal and unequal oblique parallel edge cracks, the variation of the length of the cracks and crack spacing were extensively studied and the closure phenomenon was also investigated.

9:15

In the process of designing a precision thermostat to control the temperature of a cell to less than  $0.1\text{m}^\circ\text{C}$ , the heat loss between successive shells was analyzed. We model the heat loss mechanisms allowing gas pressure, shell spacing, temperature difference and surface emissivity to vary. For low pressure (high vacuum) and small shell spacing, radiation will dominate conduction and convection. However, if moderate pressures (low vacuum) are used with moderate shell spacing, then conduction will dominate radiation and convection. Geometrical effects will be discussed as well as the effect of surface emissivity on the results.

COEXISTENCE CURVE OF PERFLUOROHEPTANE-CARBON TETRACHLORIDE.

D.T. Jacobs, Physics Department, The College of Wooster, Wooster, OH 44691

9:30

Precise measurements have been performed on the refractive index as a function of temperature in the one- and two-phase region near the consolute point in the non-polar binary liquid mixture perfluoroheptane-carbon tetrachloride. By measuring thirty data points over four decades in  $t=(T_c-T)/T_c$ ,  $3 \times 10^{-5} < t < 9 \times 10^{-2}$ , we were able to determine the critical exponent  $\beta$  to be  $0.32 \pm 0.01$  by using a properly weighted least squares fit to the data. The exact value of  $\beta$  depends on the correction taken for gravity effects and if corrections to simple scaling are allowed. The critical concentration was found to be  $(41.56 \pm 0.05)\%$  by volume perfluoroheptane. The critical temperature was determined to be  $(57.37 \pm 0.01)^\circ\text{C}$ .

LARGE EXPLOSIVELY DRIVEN PULSED ENERGY SUPPLIES. F.J. Jankowski. Wright State University, Department of Engineering, Dayton, Ohio 45435.

9:45

Pulsed energy sources may be used for research in megagauss magnetic fields, mega-atmosphere pressures, nuclear fusion power, the driving of particle accelerators, and driving laser and particle beam weapons. Using chemical and nuclear explosives to drive machines producing pulses of  $10^8$  to  $10^{10}$  joules was evaluated. The need for a repetitive, nonself-destructing machine is likely to eliminate from consideration magnetic compression generators (MCG). Pulsed magnetohydrodynamic generators (MHD) will need multiple channels to keep generated voltages below the megavolt range. To produce the magnetic field in the machine, superconducting or self-excited magnets will be required. The conductivity and temperature of the working fluid (gas) is critical to producing an efficient machine; in the reference self-excited MHD design, a conductivity of 108 siemens per meter resulted in zero power output. For these applications, nuclear fission explosives are inefficient, contaminating, and likely to have variable yield; nuclear fusion explosive sources appear attractive in principle, but have not been developed. High Explosives (HE) are available but have not been used in these quantities (tons) in this application. Deflagrating explosives appear to have promise, but have not been tried in the needed size or burn times; existing machines use burn times of four to seven seconds, as compared to burn times of several tens of milliseconds proposed here.

A DEVICE TO MEASURE LOCAL HEAT TRANSFER USING A LIQUID CRYSTAL DISPLAY OF ISOTHERMAL CONTOURS. Russell Kulas\*, Department of Physics, The College of Wooster, Wooster, OH 44691 and Steven Hippensteele, Louis Russell and Frank Pollak, NASA Lewis Research Center, Cleveland, OH 44135

10:00

A device has been examined which is under development to measure local heat transfer by air flow impinging on a hot surface. The device is a laminated composite of thin film gold and liquid crystal sheet. Joule heat is supplied at a measured rate through the gold foil. The impinging air flow is supplied by various arrays of jets. The liquid crystal shows isothermal contours of constant color. Along a contour on the surface at temperature  $T_s$ , the heat transfer coefficient  $h$ , in the heat balance equation  $q=hA(T_s-T_A)$ , can be measured. Variation of the heating rate  $q$  causes the  $T_s$  contours to move so that one may map  $h$  over the surface.

The purpose of the study was to determine the source and severity of non-uniform heating in the gold heater. Several optical and field mapping procedures were attempted with the following results: (1) The current density was shown to be appropriately conceived as parallel current strips flowing between bus bars. (2) Hot and cold spots can be related to resistivity variations. (3) A relatively low ( $\sim 10\%$ ) uncertainty in power dissipation per unit area can be achieved. (4) A reliable method for attaching bus bars has been found. (5) Improper handling of the gold sheet apparently produces microscopic cracks which cause unacceptable non-uniform heating.

\*1980 NASA-ASEE Summer Faculty Fellow at Lewis Research Center

10:15

A simple formula to predict the penetration of plumes through elevated inversions is tested using observed time-mean plume profiles from the tar sands area. The plume profiles and the associated meteorological data were collected by Syncrude Canada Ltd., Edmonton, Alberta, the operator of the world's largest tar sands plant, during March, 1977.

The formula is found to be satisfactory for estimating the degree of penetration and is given by the following equation:

$$\text{Plume Penetration} = \frac{1+\alpha}{2\alpha} - \frac{Z_i}{2\alpha Z}$$

where,  $\alpha$  is entrainment parameter ( $\approx 0.6$ ),  $Z_i$  is the inversion height above stack top and  $Z$  is the point of penetration.

10:30 BUSINESS MEETING

## E. PHYSICS & ASTRONOMY

FIRST AFTERNOON SESSION

101 TAYLOR HALL

EDWARD S. FOSTER, JR., PRESIDING

MINIMUM VOLUME AT EQUILIBRIUM B. R. Russell, Dept. of Physics, College of  
Wooster, Wooster, Ohio 44691

1:30

It is easily shown by the same formal argument used to prove that entropy is maximum at equilibrium that the volume of a simple one-component fluid system is a minimum. The standard procedure subdivides the system into two subsystems, holds one extensive variable constant in each subsystem (local constraint), and introduces equal and opposite changes in the amount of a second extensive variable in the two subsystems (global constraint). With three extensive variables there are six ways to proceed and three extrema result. A convenient way to show the minimum volume condition is to choose the entropy as the locally constrained variable, and the internal energy as the globally constrained variable. For this case a direct mechanical linkage between two cyclinders having variable-area pistons provides a pictorial explanation which is easy to grasp.

THERMAL EXPANSION OF BONE. Jeff Parker and Russell Kulas,  
Department of Physics, College of Wooster, Wooster, Ohio, 44691

1:45

Complementing recent clinical research on electrical stimulation of bone growth and repair, there have been a number of studies on electrical polarization in bone. It is conceivable that some polarization may result from thermally induced stresses. To augment research on that question we have attempted to measure the linear thermal expansion of bone. Using rods of bovine femur, we have measured the strain developed over a temperature range from 24°C to 99°C. The resultant strains ranged to  $240 \times 10^{-5}$ . The coefficient of linear thermal expansion ranged from  $-9 \times 10^{-5}$  to  $1.3 \times 10^{-5}$ . In addition, during heating both contraction and expansion were observed in separate temperature regions. Upon cooling, additional expansion, followed by contraction, was observed.

A MICROCOMPUTER BASED DATA ACQUISITION AND CONTROL SYSTEM. J.L. Tveekrem,  
D.T. Jacobs, and S.E. Hoell, Department of Physics, The College of Wooster,  
Wooster, OH 44691

2:00

We have constructed an adiabatic calorimeter to precisely measure the heat capacity of a binary liquid mixture near its critical point. This experiment is automated using a microcomputer to collect the data as well as control the thermostat. Design of the calorimeter to allow 0.3% accuracy in heat capacity measurements will be detailed. Interface consideration and instrumentation will be highlighted.

# F. GEOGRAPHY

FIRST MORNING SESSION

127 KAUKA HALL

JOSEPH URELL, PRESID.

## PERSPECTIVES ON POVERTY LEVELS AND INCOME DISTRIBUTION IN OHIO COUNTIES.

V. N. Krishnan, Department of Economics and Mohan N. Shrestha, Department of Geography, Bowling Green State University, Bowling Green, Ohio 43403

8:15

An analysis of income distribution involving the assessment of change in the poverty line adds an important dimension to an understanding of the equity in the distribution of wealth. Programs such as public welfare payments, social security, unemployment benefits, medicare, etc. have direct impact on poverty levels and the distribution of income. The purpose of this study is to analyze income distribution in relation to the change in the poverty line at the county level in the state of Ohio in recent years. An attempt is also made to determine the influence of public assistance payments in changing the magnitude and the direction of the poverty line in Ohio.

## NAVAJO HOUSING: EXAMPLE OF ENVIRONMENTAL ADJUSTMENT. Allen G. Noble, Department of Geography, University of Akron, Akron, Ohio 44325.

8:30

The housing structures of the Navajo demonstrate a fine adjustment to the demanding climatic conditions of southwestern United States. Throughout this desolate, arid region, building materials are in short supply, providing further limitations for traditional builders. The passage of the seasons altered the Navajo economy and created a need for two quite distinct dwellings. The Ramada, easily erected, often portable, and mostly lacking sides so as to permit maximum air circulation, was the common summer shelter. The Hogan, a more substantial and permanent building was occupied during the winter.

## OCCUPANCY RATES AMONG OHIO'S INDUSTRIAL PARKS.

Bruce W. Smith, Department of Geography, Bowling Green State University, Bowling Green, Ohio 43403

8:45

One recent industrial trend in the United States has been the proliferation of industrial parks. Although the industrial park concept has existed for many years, rapid growth in the number of industrial parks, particularly in rural areas, has occurred more recently.

Ohio contains substantial acreages of industrial parks in both metropolitan and rural locations, but the occupancy rates of those industrial parks demonstrate considerable variation. This paper surveys those factors which are associated with variations in the occupancy rates of industrial parks. Also the implications of these findings for rural industrialization are discussed.

## AN EMPIRICAL INVESTIGATION OF CENTRAL PLACE THEORY

Mary Ellen Mazey, Wright State University, Dayton, Ohio, 45435

9:00

The purpose of this research is to empirically examine Christaller's central place theory at the intraurban level. Christaller hypothesized that consumer behavior is strongly influenced by distance. Therefore, this research will analyze this distance factor in terms of the order of goods. According to Christaller, the distance traveled for low-order goods such as groceries or drugstore items will be less than the distance traveled for higher order goods such as clothing or furniture. Through empirical analysis this premise will be further validated or disproved. The t-test will be employed to test if there is a significant difference in the distance traveled for different order goods.

9:15

Two basic pricing strategies of goods are identified as operating for most transactions in U.S. recirculation outlets. In the first, the seller asks a price based on a computed markup to yield a "legitimate profit," assuring rapid turnover and sufficient profit to replenish his inventory. In the second strategy, a good is priced as high as possible according to what the seller believes the market will bear regardless even of his obtaining the good at low cost. Three outcomes can occur to the seller: 1. He does not sell the good thus tying up his invested capital, losing its potential interest, and losing profit. 2. He sells the good eventually, realizing a profit sufficiently large to more than compensate for both the money invested and the interest this money could have accrued. 3. He quickly finds that occasional shopper who desires the good enough to buy it even if the price is higher than most shoppers would tolerate, yielding a windfall profit.

Several minor strategies are also identified, such as discounting to attract impulse shoppers, and raising prices rather than lowering them to suggest a "pedigree" for the good and to attract shoppers motivated by conspicuous consumption. Attention-getting strategies include formulae whose computation is performed by the shopper, and bulk rates for quantities of goods with very low unit prices. These "gimmicks" add interest, humor, and atmosphere to U.S. recirculation outlets.

ESTIMATING TOTAL FERTILITY RATES FROM CRUDE BIRTH RATES. Joseph G. Spinelli.  
Department of Geography, Bowling Green State University, Bowling Green, Ohio 43403.

9:30

In 1964 Donald J. Bogue of the University of Chicago derived a formula for estimating certain direct measurements of fertility from more accessible indirect measurements. In determining the percentage of the demographic transition completed, one needs to know the Total Fertility Rate (average complete family size). This statistic is not readily available for many countries in the Third World, but it can be estimated by knowing the simple crude birth rate. Bogue derived the following formula:

$$TFR = 137.94 \cdot CBR + 106.16$$

This formula was developed from 1955-60 census data. The author of this paper wanted to test the reliability of Bogue's formula using the most recent population data to see if the original formula could still be used as a predictor of Total Fertility Rates. The results of a correlation analysis reveal that Bogue's formula continues to be valid as a predictor of the Total Fertility Rate for countries when crude birth rates are known. By estimating the TFR for countries or regions, the population geographer can analyze the spatial-temporal change in fertility decline and determine the relative location of a given country on its path through the demographic transition.

LIMITATIONS ON THE MOVEMENT OF DEEP-DRAFT TANKERS THROUGH THE MALACCA-SINGAPORE STRAITS: A GEOGRAPHIC ANALYSIS. Thomas D. Anderson, Department of Geography, Bowling Green State University, Bowling Green, Ohio 43403.

9:45

The Malacca-Singapore straits provide the shortest sea route between the Indian Ocean and East Asia. Due to shoals many of the largest tankers cannot navigate the straits; many others may do so only with planned passages. Data extracted from recent hydrographic charts were used to identify the location and character of the controlling depths in the ship channels. Details and relationships of these controlling areas are illustrated by means of specially-designed maps and sketches. Bottom features, tidal ranges, squat, ship handling procedures and coastal state regulations affect the conditional passage of many tankers. Each of these aspects is examined in its geographic context. Political and economic effects of the navigation limitations are treated in a closing statement.

SOME ASPECTS OF RECENT REAL ESTATE SPECULATION AND PRICES IN HONG KONG  
Stephen S. Chang, Department of Geography, Bowling Green State University,  
Bowling Green, Ohio 43403

10:00

Hong Kong has one of the highest residential and commercial real estate costs in the world. In recent years, prices have skyrocketed. Housing costs have risen so rapidly that the Hong Kong Government has imposed rent control, which has had little effect on the active real estate market. High commercial property rent has caused many small businesses to close.

The price rise has been fueled by real estate purchased as hedges against inflation and for rent income. Real estate speculation, in which quick profits can be made, is a more important cause of price escalation. Large developers and even small investors are very much involved in different stages of the real estate transactions. Speculators will buy up real estate to resell at a higher profit. Developers will use advance sales to finance development and increase earnings, while also speculating on some units.

Population pressure and a small land area have all led to rising market prices. However, political confidence is the most crucial factor determining the prospects of booms or busts.

#### MODERNIZATION OF A RURAL TOWN ON THE YELLOW RIVER

10:15

Shuh-Chai Lee, Ohio Department of Transportation  
4451 Woodbridge Road, Columbus, Ohio 43220

Sanmenxia, which in original Chinese language means "Three Gate-Gorge," is the first as well as the key dam site of the integrated comprehensive flood control reservoir and water resources development project of Huang He (Yellow River) of the People's Republic of China. It is also the name of the new city which was built 40 kilometers upstream from the dam to replace the old county (Xian) seat of Shan Xian, a rural town displaced by the reservoir plan. The City and County have been well known for years as important sites of ancient Chinese civilization and a large number of archeological finds of historical value were unearthed prior to the flooding of the reservoir basin.

This paper will deal with the modernization of Sanmenxia since 1947. In the thirty-three years since the author left Sanmenxia, the small rural town of 5,000 population has grown into a modern city of 55,000 population exclusive of its urban fringe. No fewer than 40 diversified industries have been developed and significant physical, social and economic changes have occurred.

Hodgkins, Jordan  
Smith, Clyde

Kent State University  
Kent, Ohio 44242

10:30

Greek residence and colonization in the northern and eastern border lands of the Black and Azov Seas in the Soviet Union dates from the seventh and sixth centuries B.C. At least twelve Greek colonies existed in that period. Over the centuries, Greek immigrants have been attracted to these same regions and have migrated inland. This paper analyzes the recent distribution of Greeks in the Soviet Union using all census data between the first Russian census of 1897, and the last published Soviet census of 1970. Within the Czarist Empire of 1897, there were 186,900 Greeks. By the end of WW I and the Bolshevik Revolution, 151.4 thousand Greeks remained in that territory. Approximately 35.4 thousand either fled the country, were lost in war, revolution, or were residing in ceded territories. Of those remaining, 104 thousand lived chiefly in the Black and Azov Sea littoral of the Ukraine and south Russia. Forty-seven thousand were located in the Transcaucasus, 1000 resided in Central Asia and another thousand were in various parts of the country. The Greek population of the Soviet Union rose to 213,765 by 1926, an increase of 14 percent in 29 years. At this time, eighty-one percent of the Greeks claimed rural residence. From 1926-1959, the number of Greeks increased by 44 percent. Fifty-four percent had become urbanized. Between 1959 and 1970, the Greek population increased by 9 percent. They totaled 336,869, with 39 percent remaining rural in residence.

10:45 BUSINESS MEETING

# G. CHEMISTRY

FIRST MORNING SESSION

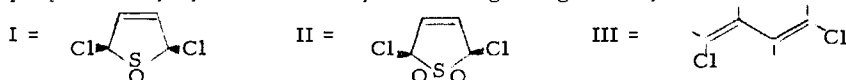
111 SEVERANCE

JOHN W. GROCE, PRESIDING

A STEREOSPECIFIC SYNTHESIS OF TRANS, TRANS-1, 4, -DICHLORO-1, 3-BUTADIENE LeRoy W. Haynes and Pam Placek, Department of Chemistry, College of Wooster, Wooster, OH 44691 and Hiram College, Hiram, OH 44234

9:00

The availability of sulfoxide I, prepared from thiophene, prompted us to attempt the conversion of I to sulfone II. Sulfone II could then be subjected to thermal and photochemical decomposition to further test the Woodward-Hoffmann rules. Unfortunately, sulfone II could not be isolated, but trans, trans-1, 4-dichloro-1, 3-butadiene (III) could. Diene III can be prepared only by a laborious synthesis beginning with cyclooctatetraene.



Evidence accumulated thus far indicates that I is oxidized to II but that II decomposes to III at the temperature necessary for the oxidation to occur. Details of the experimental procedure for the preparation and isolation of III will be given. Attempts to extend the synthesis to the dibromo analogs have not succeeded.

$S_N$  (ANRORC) REACTION OF 2-CHLORO-3-NITROPYRIDINE. J. D. Reinheimer, Nicos Sourbatis, Department of Chemistry, The College of Wooster, Wooster, Ohio 44691.

9:15

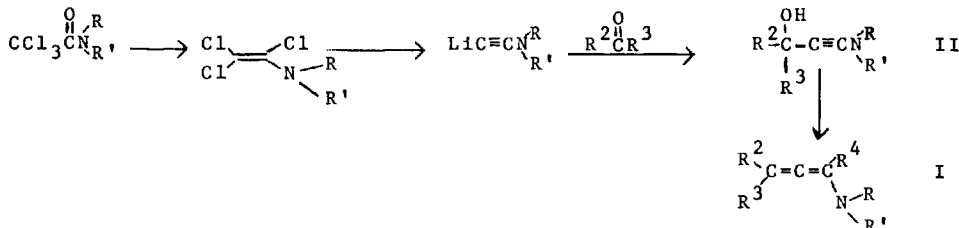
The reaction of 2-chloro-5-nitropyridine with hydroxide ion in  $DMSO$  occurred with opening of the pyridine ring to form a stable intermediate. Spectral data ( $^1H$  and  $^{13}C$  NMR, IR and U. V.) were consistent with the presence of  $O=C-H$  and  $C\equiv N$  groups in the intermediate. The reaction of 2-chloro-3-nitropyridine with hydroxide ion shows the same initial path on the basis of  $^1H$  NMR and IR spectra. A stable intermediate, "X", forms when two moles of  $OH^-$  are added. In contrast to 2-chloro-5-nitropyridine, the addition of a third mole of base to 2-chloro-3-nitropyridine does not close the pyridine ring to the expected product, 2-hydroxy-3-nitropyridine.

## AMINO ALLENES

Louise C. Hellwig and Elaine R. Turley  
Department of Chemistry  
College of Wooster  
Wooster, Ohio 44691

9:30

Few amino allenes (e.g. I) are known in the literature and then mostly as unwanted by-products. A proposed synthesis of amino allenes is:



The major problem concerns the conversion of the propargyl alcohol (II) to the amino allene (I) and this will be discussed.

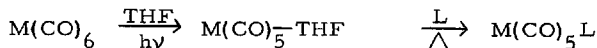
9:45

Lamellar liquid crystalline structures, specifically the phospholipids, are model biological membranes. We determine the rate of hydrolysis of benzylidene t-butyl N-oxide, I, as a function of the concentration of dodecylammonium chloride, DdAC, and maximum inhibition of the reaction occurred with the formation of the lamellar liquid crystalline phase. If the inhibition of the rate of hydrolysis of I, is the consequence of electrostatic repulsion between the positively charged protonated intermediate and the cationic liquid crystalline structure then a maximum electrostatic effect is developed by the liquid crystalline structure. An alternate explanation is that the substrate is partitioned between the water layer and the hydrocarbon region of the DdAC but the hydrogen ions are excluded from this region.

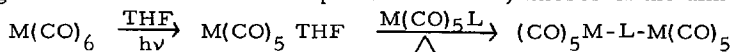
We have altered the electrostatic effect of the lamellar phase of DdAC by the substitution of didodecyltrimethylammonium chloride, DdDMAC. This highly substituted polar head group should decrease the electrostatic influence, however, the rate of hydrolysis of I, is one-fourth as fast as in DdAC. Greater partitioning of the substrate in the mixed amphiphile system appears responsible for the slower rate of hydrolysis

10:00 THE PHOTOCHEMICAL SYNTHESIS AND CHARACTERIZATION OF HOMO- AND HETERONUCLEAR LIGAND-BRIDGED DIMERS OF THE GROUP VI-B METAL CARBONYLS. P.L. Gaus, K.S. Rosengren, J.M. Boncella, and M.S. Swansiger, Department of Chemistry, The College of Wooster, Wooster, Ohio 44691.

The monomeric compounds  $M(CO)_5L$ , where L = a bidentate nitrogen heterocycle and M = W and Cr, have been synthesized by the photochemical route involving the preparation in situ of the THF adduct:



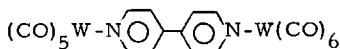
These monomeric compounds where L = 4,4'-bipyridine (or a derivative thereof) were themselves used as ligands in a second series of photochemical syntheses of the dimers:



The monomers and dimers were characterized by HPLC, PMR,  $^{13}C$ -NMR, and electronic spectroscopy. One of the most interesting features of the electronic spectra of the dimers is that the metal-to-ligand CT absorption occurs at a significantly lower energy (>430 nm) than the ligand field absorption band at 405 nm. Thus the new dimers fall into Zink's (Inorg. Chem., 16, 3154 (1977)) class 3 behavior.

10:15  $^{13}C$  AND  $^1H$ -NMR SPECTRA OF MONOMERIC AND DIMERIC DERIVATIVES OF TUNGSTEN AND CHROMIUM HEXACARBONYLS. P.L. Gaus, Department of Chemistry, The College of Wooster, Wooster, Ohio 44691 and M.O. Funk, Department of Chemistry, The University of Toledo, Toledo, Ohio 43606.

The dimeric compounds such as that shown below have been synthesized by a photochemical



route beginning with the hexacarbonyls,  $M(CO)_6$ . For this series of compounds, M = W or Cr and the bridging ligand is 4,4'-bipyridine or a derivative thereof. The  $^{13}C$ - and  $^1H$ -NMR spectra of these dimers have been compared with those of the monomeric derivatives  $M(CO)_5L$ , and also with those of the uncoordinated bipyridine ligand. Chemical shift differences are explained on the basis of the deshielding effects of a coordinated metal carbonyl.



## INFRARED LASER CHEMISTRY OF PROPANE

10:30 Marc D. Porter, Suresh C. Khandelwal, and Gordon B. Skinner, Department of Chemistry, Wright State University, Dayton, Ohio 45435

Multiple photon dissociation of propane has been investigated using a pulsed, high power TEA CO<sub>2</sub> laser. Reaction products have been measured as a function of propane pressure, pulse energy, power, and of the partial pressures of argon. Results are compared with the thermal decomposition of propane. Also, a brief overview of current work in laser chemistry will be presented.

## G. CHEMISTRY

### FIRST AFTERNOON SESSION

#### 111 SEVERANCE

JOHN W. GROCE, PRESIDING

#### 1:45 BUSINESS MEETING

2:00 STERIC EFFECTS ON REACTION RATES BY CONDUCTANCE METHODS  
Joseph W. Uffner, Michael J. Nofziger, and Thomas A. Evans, Department of Chemistry, Ebaugh Laboratories, Denison University, Granville, Ohio 43023

We have examined the influence of ring size on the solvolysis of alicyclic chlorides and the oxime formation of alicyclic ketones. The reaction rates were determined by conductance methods using an auto-balancing conductance device which can characterize reactions with  $t_{1/2} > 1$  second. The construction of the device and the results of our kinetics studies will be discussed.

2:15 STABLE ISOTOPE DILUTION GAS CHROMATOGRAPHY-MASS SPECTROMETRY METHOD FOR MEASURING CHROMIUM CONCENTRATIONS IN FOOD STUFFS

Jerry A. Clark, John H. Garrett, Shelley J. Coldiron, Michael L. Taylor and Thomas O. Tiernan, The Departments of Chemistry, Pharmacology/Toxicology, and The Brehm Laboratory, Wright State University, Dayton, Ohio 45435

In recent years, the element chromium has been found to be an essential micronutrient for man, and is involved in glucose metabolism and the action of insulin. Previous research efforts have been directed toward development of analytical methodology for the determination of the concentration of chromium in human urine -- which has been found to be on the order of 0.3ppb. In this presentation an extension of the method for urinary chromium will be described which permits analysis of the chromium content of several foods.

2:30 PYROLYSIS/GAS CHROMATOGRAPHY/MASS SPECTROMETRY TECHNIQUES FOR CHARACTERIZING NEWLY SYNTHESIZED ORGANOMETALLIC POLYMERS

Shelley J. Coldiron, Thomas O. Tiernan, Michael L. Taylor, and Charles E. Carraher, Jr., The Brehm Laboratory and the Departments of Chemistry and Pharmacology/Toxicology, Wright State University, Dayton, Ohio 45435

Polymeric materials are difficult to characterize by classical techniques of instrumental analysis. In recent years thermal gravimetric analysis (TGA) has been employed but this technique affords only weight loss data as a function of temperature. In this paper a system for characterizing polymers which entails use of rapid pyrolysis/gas chromatography/mass spectrometry and computerized data acquisition and reduction techniques is presented.

Initial TGA analysis of the polymers is performed followed by application of the pyrolysis technique to obtain molecular information on the products arising from decomposition of the polymers which occurs over a temperature range of 200°C to 900°C. Using this approach, the structure of the new polymers is determined and in addition information regarding the thermal stability and identity of pyrolysis products is obtained. A complete description of the procedures employed for polymer characterization will be given along with examples of applications of the technique.

## 3:00 AUTOXIDIZABLE COMPOUNDS IN YEAST EXTRACT (PCO).

Thomas J. Conti and Kinji Tanaka. St. Thomas Institute, Cincinnati, Ohio 45206

Cook et al. from this Institute, using a manometric procedure, found that aqueous alcoholic extracts of baker's yeast (PCO) could stimulate skin respiration and antagonize the inhibitory action of basic phenylmercuric nitrate on skin respiration. They suggested the presence of an autoxidizable substance(s) in PCO that may bypass the cytochrome oxidase system. Ohi and Tanaka, also of this Institute, using an oxygraph procedure, confirmed the respiration-stimulating activity of PCO and observed the presence of an autoxidizable substance(s) in reconstituted freeze-dried samples of PCO. Recent work has attempted to characterize further the autoxidizable substance or substances in PCO with a goal of eventual identification. Three findings are reported: 1) apparent oxygen consumption by PCO is increased as the pH is raised (oxygraph); 2) methanol-insoluble fractions of PCO have higher oxygen consumption than soluble ones (oxygraph); and 3) the redox potential of PCO appears to be in the area of  $\text{Fe}^{2+}$  vs  $\text{Ce}^{4+}$  (potentiometric titration).

## G. CHEMISTRY

### SECOND AFTERNOON SESSION

#### 210 SEVERANCE

#### 1:45 BUSINESS MEETING 111 SEVERANCE

2:00 pH OF NATURAL WATERS IN U.S. AND WESTERN EUROPE. Bruce V. Weidner, 308 University Avenue, Oxford, OH 45056.

The pH of natural waters in Western Europe obtained between February 20 and May 1, 1980 with emphasis on Luxembourg and South Central England will be presented. Also the pH of natural waters in the area of Mt. St. Helens obtained in mid July, 1980.

2:15 ELEMENTAL RESIDENCE TIMES IN ACTON LAKE, OHIO. William J. Green and Thomas J. Gardner. School of Interdisciplinary Studies (Western College Program) Miami University, Oxford, Ohio 45056.

Studies are currently underway to determine the residence times of selected elements in a hardwater, eutrophic Ohio reservoir. Trends in elemental residence times for this water body will be compared with observed trends in ocean residence times to determine what factors are important in controlling the behavior of chemical species in lakes. Residence time is defined as the average period that an element resides in a given water body, and is given by the relationship:  $\tau = A/(dA/dt)$ , where  $\tau$  = the residence time (years),  $A$  = the kilograms of the element in the water body, and  $(dA/dt)$  is the rate of input (or output) in kilograms per year. Values for  $\tau$  in Acton Lake are being estimated using streamflow data and measured elemental concentration for Fe, Mn, Na, K, Cl, Ca and Mg. Preliminary results indicate that the order of elemental residence times in this lake is:  $\text{Mn} > \text{Fe} > \text{Na} > \text{K} > \text{Cl} > \text{Ca} > \text{Mg}$ ; while in the seas the order is:  $\text{Na} > \text{K} > \text{Cl} > \text{Ca} > \text{Mg} > \text{Fe} > \text{Mn}$ . The unexpected high values for Fe and Mn in the lake may be explained in terms of redox reactions in the anaerobic hypolimnion and subsequent elemental recycling, while the shorter residence times for Ca and Mg in the lake are discussed in terms of carbonate precipitation. Several generalizations concerning the fate of chemical species in lakes and reservoirs are then suggested as a result of these studies.

COMPARISON OF SEDIMENT INTERSTITIAL WATER DISSOLVED ORGANIC CARBON IN THE THREE  
MAJOR BASINS OF LAKE ERIE AND SOME POLLUTED HARBORS

2:30

David A. Deis\*, Nicholas J. Fendinger, Daniel J. Wagel and JoAnn Henry  
Dept. of Chemistry, Wright State University, Dayton, Ohio 45435

The sediments of eight stations in the three major basins of Lake Erie (Eastern, Central, Western) and two polluted harbors (Cleveland Harbor and Hamilton Harbour, Lake Ontario) were sampled with diver-collected cores and by gravity coring during 1979-1980. Interstitial water was removed from the sediments and analyzed for dissolved organic carbon. The highest concentrations, for close interval profiles of the sediment cores, were found in the polluted harbors. These ranged from 11 to 48 mg/l for Cleveland Harbor and 22 to 257 mg/l for Hamilton Harbour (2 stations). The Eastern Basin had the highest concentrations of the three major basins, ranging from 15 to 32 mg/l as compared to 12 to 25 mg/l and 2 to 14 mg/l for the Central Basin (2 stations), 2 to 16 mg/l for the Islands Area, and 10 to 23 mg/l for the Western Basin. Factors influencing differences in concentration and distribution of dissolved organic carbon in the sediment interstitial water include overlying water currents and productivity, nature of the sediment source material, anthropogenic loading and disturbance of the sediments by organisms and water turbulence.

THE OCCURRENCE OF DISSOLVED SEDIMENTARY INTERSTITIAL METHANE IN LAKE ERIE AND  
NEARBY HARBORS. Nicholas J. Fendinger\*, David A. Deis, Daniel J. Wagel,  
JoAnn Henry and T.G. Fish, Department of Chemistry, Wright State University,  
Dayton, Ohio 45435.

3:00

The distribution of dissolved sedimentary interstitial methane was determined from benthos-collected cores in Lake Erie's eastern basin and diver-collected cores from Cleveland Harbor, Hamilton Harbour and Lake Erie's central and western basins. All cores were processed immediately aboard ship in a helium filled glove box. Analysis of methane and four other gases ( $\text{CO}_2$ ,  $\text{N}_2$ , Ar and  $\text{O}_2$ ) was accomplished using a headspace equilibration technique and dual detector gas chromatography. Pore water methane concentrations as high as 147  $\mu\text{l/ml}$  were found in Hamilton Harbour sediments. In Cleveland Harbor and Eastern Basin sediments dissolved methane concentrations ranged from 16.06  $\mu\text{l/ml}$  to as much as 80.08  $\mu\text{l/ml}$ . Stations located in the western and central basins of Lake Erie had concentrations of 3.18  $\mu\text{l/ml}$  and increased with depth to as much as 51.12  $\mu\text{l/ml}$ . Distribution of methane in the sediments is regulated by sedimentation rates, origin of the sediments, and the amount of anthropogenic carbon loading. Sediment profiles of cores collected in Lake Erie's central and western basins suggested diffusive loss of methane. The sediment oxygen demand resulting from the oxidation of methane lost from the sediments can be significant.

DETERMINATION OF POLYCHORINATED DIBENZO-p-DIOXINS AND POLYCHLORINATED DIBENZOFURANS  
IN INCINERATOR EFFLUENTS

3:15

G.F. VanNess, J.G. Solch, J.H. Garrett, M.L. Taylor, and T.O. Tiernan, Brehm  
Laboratory and Department of Chemistry, Wright State University, Dayton, Ohio 45435

The incineration of refuse has long been considered an acceptable method for the disposal of solid waste. However, the presence of chlorinated materials in refuse could conceivably give rise to a number of objectionable compounds which could subsequently be released to the environment. Some of the chlorinated compounds which may be formed during incineration include polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans, which are remarkably toxic, especially when the 2,3,7,8 positions are chlorinated. Analysis of stack effluents from certain incinerators have recently been accomplished in our laboratory and various tetrachlorodibenzo-p-dioxin isomers, including the highly toxic 2,3,7,8-tetrachlorodibenzo-p-dioxin, were found to be present in these samples. Also present in measurable quantities were the higher chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans. This presentation will describe the high resolution gas chromatography-mass spectrometric techniques employed and the data obtained during initial attempts to characterize the toxic chlorinated organic components of incinerator effluents.

3:30 YOUR ARMPITS, HORSEPOWER AND THE ENVIRONMENT: A SEMI-HUMOROUS THERMOCHEMICAL LOOK AT BRAND RG AEROSOL SPRAY DEODORANT. Philip Mariotti, Earth Science Department, Ashland College, Ashland, OH 44805.

An 85 gram (net) can of Brand RG spray deodorant yields approximately  $20,700 \text{ cm}^3$  of gas at one atmosphere pressure and room temperature. The volume of the empty can is approximately  $200 \text{ cm}^3$ . If this expansion is done isothermally and reversibly, about 2474 calories of work is done. In horsepower (1HP = 178 cal/sec), this is about 13.9--for a one second expansion. If, during manufacture, the can is pressurized in one second by a process with 4.5% thermal efficiency, this 13.9HP becomes about 300HP.

The propellants in Brand RG spray are listed as butane and propane--I shall assume 50% of each. The expanded volume of these is about  $.7 \text{ ft}^3$ . Assuming the heat of combustion of this gas mixture is  $2700 \text{ BTU/ft}^3$ , the can contains around 1870 BTU (476,000 cal.) of propellant. If the combustion occurred in one second, it would yield in the vicinity of 2600 HP.

It is concluded that Brand RG spray deodorant is not environmentally safe when viewed from the standpoint of work lost--- such is the price of the luxury of not putting one's hands near one's armpits.

4:00 ABANDONED DUMP SITES-A Legacy from the Past  
Gary F. Bennett  
Professor of Biochemical Engineering  
The University of Toledo  
Toledo, Ohio 43606

Although the Love Canal has received most of the media attention for its many problems, there are estimated to be more than 1000 abandoned dump sites in the United States that will require remedial work and of this 100 many now pose significant health environmental threats.

In this paper, the author reviews some of the problems at known sites, such as the Love Canal, Seymour, Indiana, Deerfield, Ohio and Kingston, New Hampshire. Why the problem arose and how these sites pose a threat to the nation are also covered. In his discussion, the author discusses the options available to engineers for remedial action.

## H. SCIENCE EDUCATION

FIRST MORNING SESSION

KAUKE TOWER ROOM

JOY LINDBECK, PRESIDING

8:45 THE MAKING OF A CITY, Ruth W. Melvin, 8535 Winchester Road, Carroll, Ohio 43112

On a glacial landscape in 1812 the legislators of Ohio plotted a capital on the forested banks east of the Scioto River. The geological environment, the settlement pattern, and the rapid expansion of Columbus contributed to a unique heritage. In a recent project sponsored by The Center of Science and Industry these aspects of the urban environment are examined and described in an effort to encourage people of all ages to become aware of the geologic background, the history, the architecture, and the building materials which make it intensely interesting in innumerable ways.

TEACHING OHIO STUDENTS ABOUT THE MARINE AND AQUATIC ENVIRONMENTS: PROGRAMS OF THE OHIO CENTER FOR AQUATIC EDUCATION. Victor J. Mayer, Ohio State University, 1945 North High Street, Columbus, Ohio 43214.

9:00

Recent studies have described the attitudes and knowledge of Ohio children regarding the marine and lake environments. Those children living near Lake Erie have higher levels of knowledge and attitudes about both lake and marine environments.

Ohio Sea Grant operating through the Ohio Center for Aquatic Education and the Ohio Department of Education has a three-year program to assist teachers throughout the State to incorporate into their curricula, concepts and materials relating to the marine and aquatic environments. It will provide one-day awareness workshops in different regions of the State and several implementation workshops. The Ohio Sea Grant Education Program has completed 23 investigations for use in middle and junior high schools. Each is interdisciplinary, focusing on a concept or process relating to the Great Lakes and marine environments.

The Center has coordinated several other programs funded through the National Science Foundation, such as, a one-week leadership workshop for school administrators and teachers conducted at Put-in-Bay. Other activities planned by the center will be discussed. Through its activities the Center will assist teachers in efforts to raise the knowledge and attitudes toward Lake Erie and the marine environment of all Ohio children at least to the level of those living near the lake.

MINIMIZING LIABILITIES IN SCIENCE CLASSROOMS. Dr. Piyush Swami. Assistant Professor, University of Cincinnati, Cincinnati, Ohio. 45221

9:30

Science teachers have often been concerned about the potential dangers that exist in their laboratories. A number of legal claims have been made against teachers in cases of accidents and resulting injuries. The presentation will

deal with a description of such cases and also of some others that were decided in favor of the teachers. A list of suggestions aimed at minimizing the potential of serious liability claims against teachers will be discussed.

SCIENTIFIC RESEARCH FOR HIGH SCHOOL STUDENTS. John F. Schaff and Jerome E. DeBruin. College of Education, University of Toledo, Toledo, Ohio 43606.

9:45

A four year old Student Science Research Program provides talented high school students the opportunity to engage in a concentrated research experience outside school, working either on a research team, or under the direct supervision of a practicing research scientist. Students use research facilities at Owens-Illinois Technical Center, the Medical College of Ohio at Toledo, or The University of Toledo. The program consists of three components: (a) a concentrated eight-week summer research experience; (b) seminar sessions held twice weekly during the summer; and (c) five biweekly sessions in the fall which focus on writing a research report or publishable article, and preparing an oral presentation describing the research study and results. Student participants enroll for six quarter-hours of undergraduate credit at The University of Toledo. They have jointly published their results in scientific journals with their research advisors, presented papers at Junior Science and Humanities Symposia, and presented papers at the Ohio Academy of Science annual meetings.

10:15 A. M.

SYMPOSIUM: "INVERTEBRATES IN THE CLASSROOM"

CO-SPONSORED BY SECTION A. ZOOLOGY AND SECTION H.  
SCIENCE EDUCATION.

10:15

Frogs are frequently used in introductory courses in biology to demonstrate physiological phenomena and to teach anatomical organization. The host-parasite relationship is very easily added with very little equipment and modest knowledge by the instructor. Double pithed live frogs obtained from the field or from a biological supply house may be utilized but we use fresh frog carcasses from physiology classes when available. Students are divided into four person teams with each given a carcass or pithed frog. Instructions are to examine a variety of organs and regions for helminth and protozoan parasites. These include skin, muscle, blood, body cavity, lungs, stomach, small intestine, large intestine, liver, gall bladder, and urinary bladder. All of these except the skin have yielded parasites. Among the more frequent parasites encountered are the frog lung fluke, Haematoleuchis, the fluke Diplodiscus from the lower alimentary canal, pleurocercoids in muscle, and flagellates Opalina and Trichomonas. Techniques for isolation and preservation are demonstrated. What begins as a lab where students show little enthusiasm usually winds up as a lab with high student interest.

#### TECHNIQUES FOR THE STUDY OF INVERTEBRATE BLOOD CELLS

10:30

Spencer E. Reames  
Benjamin Logan High School  
Box 98  
Zanesfield, Ohio 43360

Invertebrate blood cells (hemocytes) can be easily studied by using established techniques. The use of invertebrates also affords an opportunity for the study of cellular immune responses. The two major difficulties with the study of these cells lies in the classification and the fact that coagulation of the hemolymph occurs. This paper will deal with techniques that can be used to study the cells, and with the nomenclature of invertebrate hemocytes.

#### HYDRA NEMATOCYSTS: INHIBITION BY PREY FLUIDS RELEASED DURING FEEDING.

10:45

Randall J. Ruch and Clayton B. Cook, Department of Zoology, The Ohio State University, Columbus 43210.

During feeding, hydra do not use all of their nematocysts when prey-killing ceases.

We have found that an alteration in the external medium occurs which inhibits stenotele firing. Hydra killed fewer prey when fed in "used" medium (in which hydra had been previously fed) than when they were fed in "fresh" medium. We observed this both with intact hydra and with isolated hypostomes with attached tentacles, indicating that the effect acts directly on the tentacle-hypostome complex. Prey extracts also reduced prey-killing. These results suggest that the effect is due to a metabolite released from the prey during prey-killing.

(supported in part by a Sigma Xi grant-in-aid to RJR.)

## H. SCIENCE EDUCATION

### FIRST AFTERNOON SESSION

#### KAUKE TOWER ROOM

#### PIYUSH SWAMI, PRESIDING

#### FIELD AND CLINICAL/DIAGNOSTIC EXPERIENCES IN A SECONDARY SCIENCE METHODS CLASS.

Dr. Joy Lindbeck, The University of Akron, Akron, Ohio 44325. Dr. Evan McFee, Bowling Green State University, Bowling Green, Ohio 43403.

1:30

Field and clinical/diagnostic experiences in a secondary methods class were devised to meet the guidelines of the State of Ohio Teacher Redesign. Students completed a required core of field and clinical/diagnostic activities plus selected options. Designs and achieved goals as well as problems of implementation to meet the State of Ohio Standards by the University of Akron and Bowling Green State University are presented.

1:45

Environmental communications students at Ohio State organized and implemented a public information symposium on hazardous wastes in the state. The half-day meeting, held six days after regulations of the Resource Act went into effect was designed to acquaint OSU students and interested citizens with the magnitude of the problem in Ohio and how the regulations address that problem. Specific characteristics of disposal sites in the state were also considered through the symposium's format of lectures, displays and visual presentations.

Two techniques were used to assess the successfulness of the public meeting as a communication device. Post-test knowledge scores of 100 participants were 20% higher than pretest scores, and attitudes of the same group changed significantly between testing periods as well. A conference evaluation returned by 130 participants indicated that 46% felt their knowledge had increased significantly. Most felt that lectures illustrated by slides were the most effective presentations in terms of providing knowledge about hazardous wastes. Comments by evaluators provided numerous ideas for future extensions of conference format.

THE RELATIONSHIP OF SCIENTIFIC LITERACY AND DEGREE OF FIELD DEPENDENCE/INDEPENDENCE AMONG SEVENTH GRADE SCIENCE STUDENTS. Wallace W. Black 11, 2270 Blue Valley Road, Lancaster Ohio 43130.

2:15

Gabel's (1976) Scientific Literacy Q-Sort, which assesses perceived dimensions of scientific literacy among groups of individuals, and Donlon's (1977) Figure Location Test, which measures an individual's degree of field dependence/independence, were administered to 148 seventh grade science students, along with a semantic differential measuring students' attitudes toward each test. The purposes of the study were (1) to infer dimensions of scientific literacy for the field dependent and field independent groups of students; (2) to compare the strength of agreement between the inferred dimensions of scientific literacy of the two groups; and (3) to determine the usefulness of the SLQ and the FLT for junior high science students. Semantic differential results indicate that both tests are useable with junior high students. Factor analyses are being done to the SLQ responses to determine the inferred dimensions of scientific literacy for the two groups. T-tests will be done to determine the significance of the difference between the factor scores of the groups. Factor analysis and T-test results will be available in January, 1981. Studies such as this will aid in evaluating students' science achievement in a more humane manner, in choosing teaching strategies most beneficial for the science student, and in providing a basis for science programs which will allow students to develop functional levels of scientific literacy.

MORPHOLOGY - - A BIOLOGICAL TOOL

2:30

Anneliese DiGiacomo  
Butler Senior High School  
600 South Dixie Drive  
Vandalia, Ohio 45377

The traditional biology collection exercise has been replaced by a more meaningful investigation. The student develops a scientific tool, the "Ohio Morphological Leaf Collection," which makes him cognizant of variation and how some vegetation is related through common characteristics. In a three week Orientation and Leaf Collection Unit students are exposed to lecture-demonstration with transparencies, films, filmstrips and models. The laboratory is used simultaneously to develop skills, concepts, cognitive ability and understanding. The full range of indoor learning is evaluated with a self guided three page field trip, on the school grounds. Although certain observations are directed by this worksheet there is team work and discovery as well. Diversity of sensory experiences such as smelling, hearing, feeling and tasting are recorded. The student then participates, as a biologist, in collecting, preserving, mounting and identifying leaf morphology. Independent student goals are set and encouragement is given to use every possible source in the environment. Through this external study of the morphology of leaves many of the learning concepts that the students use throughout the year are introduced.

MEETING THE SCIENCE REQUIREMENTS AT THE UNIVERSITY OF AKRON 1950-1980  
John Frola, Department of Biology and Jim Jackson, Department of Geology,  
The University of Akron, Akron, Ohio 44325

2:45

In the early 50's the non-science major found no options to meeting the science requirement other than introductory courses in the respective science departments. The strong chemistry program produced a failure rate in excess of 70% in freshmen chemistry, and a need for a separate track for non-science majors was documented. An interdisciplinary course, Reasoning and Understanding in Science, was initiated as part of the General Studies curriculum. The course was team taught, but members of the team soon had other pressing activities to consume their time. The "Sputnik" reaction increased enrollment when the municipal University of Akron became a State University in 1967 and pressure from science departments lead to more specialized courses. Peak enrollment in the general studies science courses was reached in 1971, when 6438 enrolled. New non laboratory options offered by science departments led to a decline in general studies science course enrollment to 1477 in 1976. Recent innovations in the general studies courses have produced increased selection of these courses over the past three years. Improvements include auto-tutorial instruction, color videotapes produced on location, live discussion groups and increased laboratory modules that permit increased concept and content have led to a current enrollment of over 1600.

HOW TO HOLD A SOLAR ENERGY FIELD DAY

3:00 Ed Corley, National Trail High School, RR# 2, New Paris, OH 45347

Freshman science students at National Trail have participated in an annual Solar Energy Field Day for the past three years. Although the Field Day works best as an integral part of a complete energy education unit, it can stand alone as an interesting and educational experience to celebrate the end of winter as an early Spring activity. Activities that will be discussed include student construction and use of a solar hot dog cooker and experiments dealing with differential heating of various kinds and colors of surfaces, insulation, passive collection systems, radiometers, and a demonstration of Fresnel lens. Slides of students performing the various experiments will be shown. Construction tips will be given on how to make the various simple pieces of equipment needed. Copies of student data sheets will be available for participants. Discussion will also cover the teacher preparation necessary to head off troublesome headaches associated with having 120+ ninth graders all needing your help at the same time.

3:30 BUSINESS MEETING

## I. ANTHROPOLOGY & SOCIOLOGY

FIRST MORNING SESSION

2 KAUK HALL

STEPHEN B. McCONNELL, PRESIDING

9:00 THE GIBBS SETTLEMENT AREA: A CLUSTER OF SANDUSKY TRADITION VILLAGES IN SANDUSKY COUNTY, OHIO. Jonathan Bowen, Dept. of Archaeology, The Ohio Historical Society, I-71 and 17th Avenue, Columbus, Ohio 43211

The Gibbs Settlement Area is an approximately 640 acre tract in Sandusky County, Ohio, which contains the sites of at least five Sandusky Tradition villages that were occupied serially during the period of ca. A.D. 1325-A.D. 1500. This provides an excellent location to study culture change. During the period that these villages were occupied, the Sandusky people adopted maize/beans horticulture and wattle-and-daub architecture. Also, they began to manufacture and use shell-tempered pots with strap handles, polished flint celts, elk antler celts, bear femur beamers, cylindrical bone drifts, rib "musical rasps", and deer antler "arrow-shaft wrenches". An explanation for this relatively rapid cultural change is being sought through further field work at the Gibbs Settlement Area.



INTERPRETATIONS OF THE PETROGLYPHS IN THE CHINLE FORMATION, PETRIFIED FOREST NATIONAL PARK, ARIZONA. Judith L. Anilosky, The College of Wooster, Wooster, Ohio 44691.

9:30

Petroglyphs on desert varnish surfaces in the Chinle Formation in the Petrified Forest National Monument represent the Puebloan, Great Basin, and Navajo cultures which have been represented in this area of Arizona since before 1100 A.D. Most of the petroglyphs have been produced by indirect percussion or pecking with a hammer-stone and chisel. The majority of the petroglyphs appear to be symbolic, religious, or ceremonial; some are clan symbols. The petroglyphs have been examined using interpretations of previous workers with southwestern United States petroglyphs. Because previous petroglyph workers have disagreed on the purpose of petroglyphs, the Petrified Forest petroglyphs are considered as possible examples of the writing theory, ceremonial/religious, and art form hypotheses.

THE POWER OF STREET LEVEL BUREAUCRATS IN HUMAN SERVICE BUREAUCRACIES.

Joanne Marchione, College of Nursing, University of Akron, Akron, Ohio 44325

9:45

The power relationship between street level bureaucrats and administrative level bureaucrats in Human Service Organizations have been examined in this study. It is suggested that the source of power of case workers, teachers and hospital staff comes from their unique boundary role as mediators between the bureaucracy and its 'street level' environment. By manipulating the information available to the organization about its clients street level bureaucrats can limit the agency's ability to influence their behavior. The mechanisms and the political environment of this manipulatory activity are discussed.

SOCIO-DEMOGRAPHIC FACTORS RELATED TO AFDC AND MENTAL HEALTH SERVICE UTILIZATION.

Atlee L. Stroup, The College of Wooster, Wooster, Ohio 44691 and Peter Lee, San Jose State University, San Jose, California 95192.

10:15

The study focuses on the use of socio-demographic indicators to predict social problem prevalence and/or social service utilization in a northern California county. From 37 census tract variables are chosen a sub-set of 12 for analysis. These are related to two dependent variables, namely AFDC and mental health service utilization. Conceptually three main categories of independent variables, familism-urbanization, segregation and stratification, plus Hispanic concentration and crowding, are delineated. Regression equations predicting AFDC and mental health service utilization are compared and contrasted. Advantages and disadvantages of the social indicator approach to need assessment are discussed.

10:45 BUSINESS MEETING

## I. ANTHROPOLOGY & SOCIOLOGY

FIRST AFTERNOON SESSION

2 KAUKA HALL

STEPHEN B. McCONNELL, PRESIDING

A PROFILE OF OLDER PEOPLE IN RURAL AND URBAN LOCATIONS, William Laurie and William Shook, 15787 Forest Hills Blvd., East Cleveland, Ohio 44112

1:30

We compared the well-being of older people in rural and urban locations. We also obtained information on transportation, housing, employment, and income of these older people. This data were obtained from three locations--Cleveland, Ohio (urban); Lane County, Oregon (rural and urban); and Gateway Health District, northeastern Kentucky (rural). These locations were chosen because comparable data were available for people 65 years old and older living there.

People in rural northeastern Kentucky were generally in worse condition--with respect to health, security, loneliness, and outlook on life than people in Cleveland or in rural and urban Lane County. Older people in rural and urban Lane County were less impaired than people in either Cleveland or rural northeastern Kentucky.

Many older people needing help were not receiving all the help needed. This unmet need ranged from 47 percent of those people needing help in rural Lane County to 71 percent in rural northeastern Kentucky. The predominant source of help was the family and friends.

2:00

The paper attempts to clarify the relationship between whites' socioeconomic class and their racial attitudes by testing the sensitivity of the observed relationship to changes in the operational definition of class and in the control variables employed. Class is measured by traditional variables of occupational status, income, and education, as well as an interactive variable denoting the congruence of low occupation, income, and education. In addition, two non-traditional subjective measures are used based on respondent perceptions of their relative standing in the income distribution and to recent changes in their financial position. The white racial attitude analyzed was disposition toward residential integration. Data came from a 1975 sample of 545 white household heads in Wooster, Ohio. Bivariate analyses show that several class variables were correlated with integration attitudes. Multivariate analyses, however, indicate that only if class is operationalized as education does a statistically significant, nontrivial magnitude of relationship persist, even when controlling for the effects of other variables. This suggests that the white class/racial attitude relationship is highly sensitive to both the way in which class is operationalized and in methodology employed.

FRIENDSHIP TIES AND LEADERSHIP IN A RETIREMENT HOME. Jason Weber, The College of Wooster, Wooster, Ohio 44691.

2:30

Focus of this gerontological study is on friendship ties and leadership among residents of a retirement section of a nursing home. Professional staff members answered questions of a sociometric nature regarding general leadership, committee potential, committee ability and popularity of residents. Regression equations predicting these dependent variables were developed, focusing primarily on mental status, physical health, location of residence, previous occupational family status, length of residency, and age. Sociograms of perceived interaction and friendship choice were then developed. Problems of use as well as potentials of the sociometric approach with retirement or nursing home residents are given attention in the paper. Forty-one residents, seven males and thirty-four females, formed the population of the study.

STUDS TERKEL AS SOCIOLOGIST, Stephen B. McConnell, Department of Sociology, University of Toledo, Toledo, Ohio 43606

3:00

This paper examines the salience of Studs Terkel's work for contemporary sociology. It contends that were sociology and other social sciences to become neglectful of Terkel, it would be at their peril. It is argued that if sociology becomes unmindful of Terkel, history and journalism will aggrandize him as their own, and an important humanistic source will be lost to sociology.

As sociology becomes ever more technically oriented, it is less clear that the discipline focuses on an explanation of human values and patterns of conduct. Sociology, with its most prestigious journals increasingly filled with abstruse formulae, should not abandon wholly an orientation that people-as-people are of central importance to the discipline. Terkel's books are seen as antidote to a growing non-humanistic direction which sociology is taking.

## J. CONSERVATION

MORNING SESSION

5 KAUKA HALL

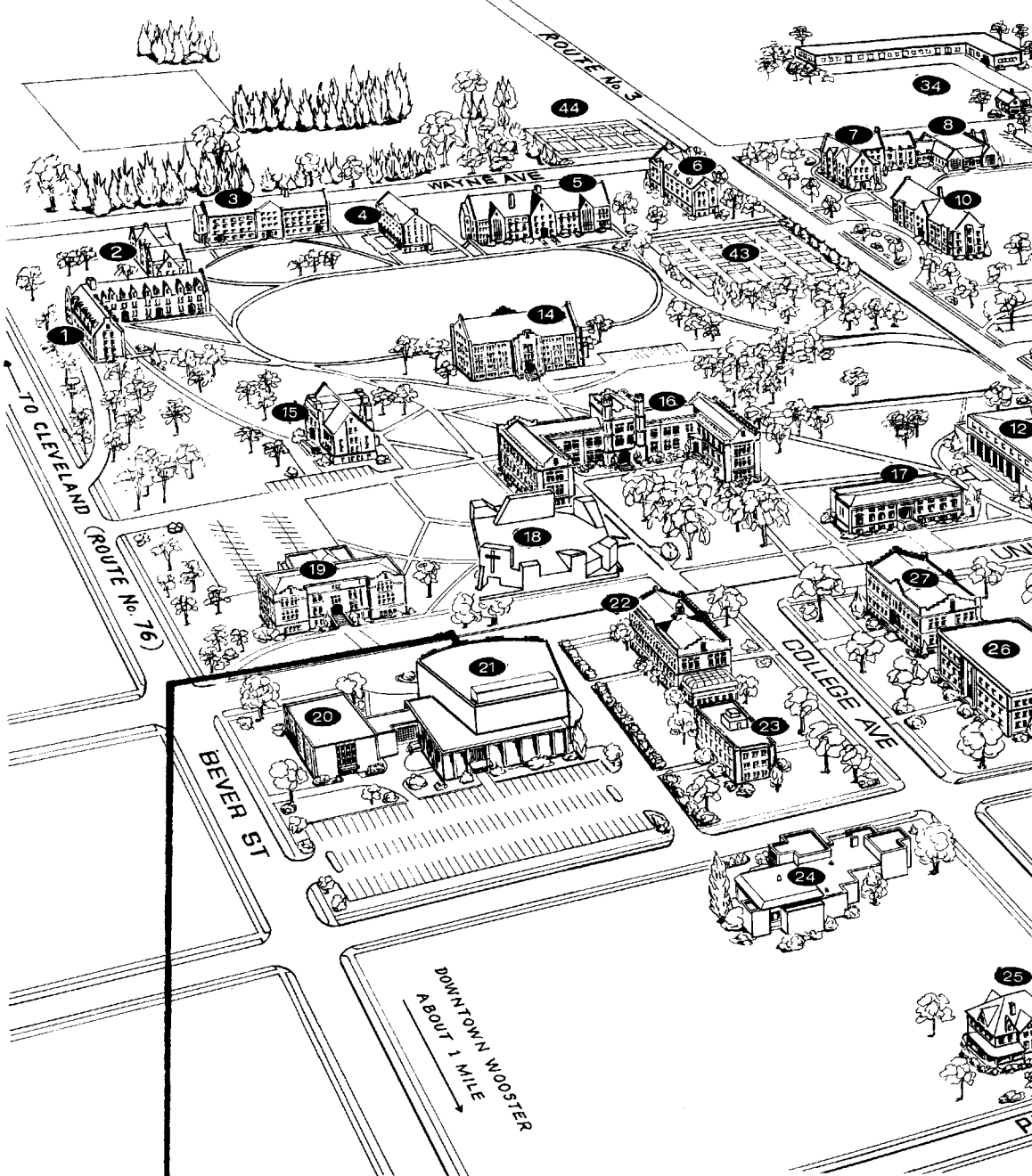
JOHN P. BAY, PRESIDING

10:30 BUSINESS MEETING

No papers are scheduled this year for the Conservation Section. Members are urged to attend other sectional meetings. Two special field trips have been planned. At 1:30 P.M. members may visit the Ohio Agricultural Research and Development Center. Meet in the conference room of the Fisher Auditorium. At 3:30 P.M. a field trip is planned to Brown's Lake Bog. Meet at main entrance of Fisher Auditorium at OARDC.

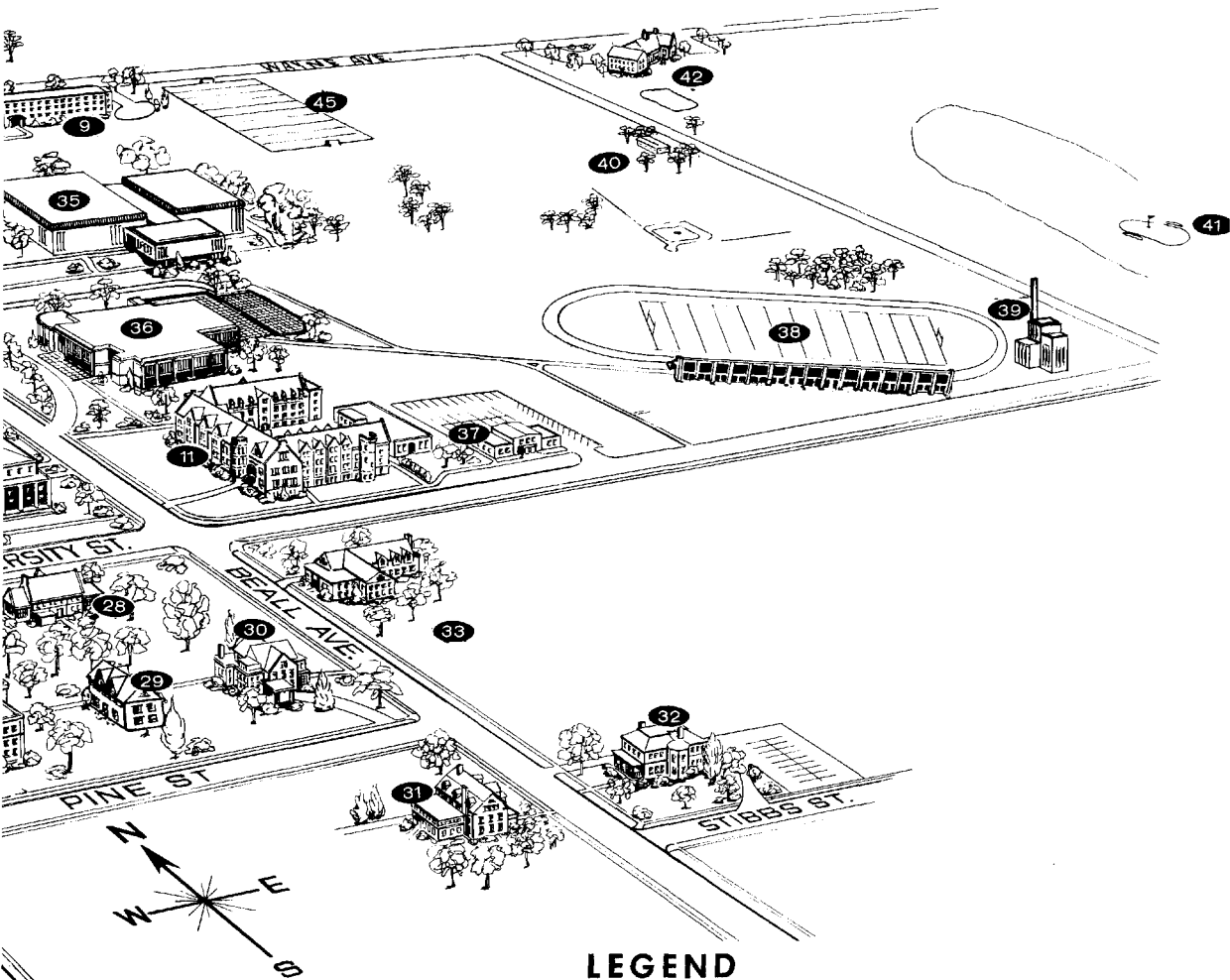
See first part of program for a more complete description of these field trips.

# MAP OF THE COLLEGE



## Registration

# GE OF WOOSTER



## LEGEND

- |  |                             |  |
|--|-----------------------------|--|
| 1 Kenarden Lodge                       | 18 McGaw Chapel             | 35 Physical Education Center                   |
| 2 Andrews Hall                         | 19 Taylor Hall              | 36 Lowry Center                                |
| 3 Armington Hall                       | 20 Wishart Hall             | 37 Music Annex                                 |
| 4 Stevenson Hall                       | 21 Theatre                  | 38 Severance Stadium                           |
| 5 Douglass Hall                        | 22 Scovel Hall              | 39 Herman Westinghouse<br>Memorial Power Plant |
| 6 Bissman Hall                         | 23 Hygeia Hall              | 40 Golf House                                  |
| 7 Otelia Compton Hall                  | 24 Westminster Church House | 41 No. 1 Green - Bales Memorial<br>Golf Course |
| 8 Kittredge Hall                       | 25 Crandell House           | 42 The Wooster Inn                             |
| 9 Wagner Hall                          | 26 Mateer Hall              | 43 Gen. Hard Memorial<br>Tennis Courts         |
| 10 Babcock Hall                        | 27 Severance Hall           | 44 Warren Memorial<br>Tennis Courts            |
| 11 Holden Hall                         | 28 President's Home         | 45 Carl W. Dale Soccer Field                   |
| 12 Andrews Library                     | 29 Practice House           |  |
| 14 Severance Gymnasium                 | 30 Merz Hall                |  |
| 15 Galpin Memorial<br>(Administration) | 31 Westminster Cottage      |  |
| 16 Kauke Hall                          | 32 Miller Manor             |  |
| 17 Art Center - Frick Hall             | 33 Alumni House             |  |
|  | 34 Service Building         |  |

# K. GENETICS AND CELL BIOLOGY

FIRST MORNING SESSION

228 KAUK HALL

BONNIE LAMVERMEYER, PRESIDING

THE HISTOLOGICAL EFFECTS OF MATERNAL ETHANOL CONSUMPTION ON THE DEVELOPING RAT.  
Bonnie L. Lamvermeyer and Gretchen C. Gerle, Department of Biology, Denison  
University, Granville, Ohio 43023

9:15

In light of the publicity received by studies of possible detrimental effects of maternal alcoholism on human prenatal development, data are presented on the effects of ethyl alcohol consumption by pregnant rats. The first series of experiments were designed to explore the fetal effects of maternal consumption of various ethanol-rich diets (10, 20, and 35 percent respectively) for the duration of pregnancy. The second series of tests compared the effects of short-term maternal consumption of a 20 percent ethanol enriched diet for different trimesters of the gestational period. Consumption during the first trimester resulted in a decreased percentage of deliveries from known pregnant rats. It was found that the incidence of congenital anomalies was significantly increased when ethanol was consumed during the second trimester of pregnancy. The most frequent effects were seen in the central nervous system, showing significant changes even when ethanol exposure was limited to the last trimester. The results from the experimental series designed to compare the effects of different levels of ethanol exposure were inconclusive due to a small number of deliveries from this series of animals.

A MORPHOMETRIC SYSTEM EMPLOYING STEREOLOGIC TECHNIQUES AND FORTRAN COMPUTER PROGRAMMING FOR QUANTIFYING CELLULAR DYNAMICS IN THE RAT EPIDIDYMIS.  
Roman J. Miller and Gary J. Killian. Department of Biological Sciences, Kent  
State University, Kent, Ohio 44242.

9:30

A sensitive morphometric technique, which quantifies subtle structural alterations, was developed to record cellular dynamics in an organ having multiple histologic compartments and cellular populations. Epididymides from mature Sprague-Dawley rats were separated into six histologically definable regions. Tissues were fixed in glutaraldehyde and osmium tetroxide and embedded in Epon 812. Thick sections (0.5-1.0  $\mu$ m) were cut for light microscopy and stained with Toluidine blue. Thin sections (80-100 nm) were cut for electron microscopy and post-stained with uranyl acetate and lead citrate. A coherent multipurpose acetate test grid, containing regularly spaced points and line segments, was superimposed on photomicrographs of different cell types from each epididymal region. Primary data were obtained by counting grid points and line segments which fell on a specific micrograph test area. To simplify record keeping and maintain calculation accuracy, these data were stored and analyzed using a FORTRAN IV computer program. The computer program used stereologic formulas to determine volume, area, and density parameters at the tissue, cellular, and organelle levels. Program output included numerical and graphic representation of the data as well as means and standard errors for measured parameters of each cell population. The versatility and operational simplicity of this morphometric system should make it applicable to many organ-tissue-cell studies.

CHROMOSOME BREAKAGE IN NATURAL POPULATION MR LINES OF DROSOPHIA MELANOGASTER.  
R. K. Brodberg and R. C. Woodruff, BGSU, Bowling Green, Ohio 43403.

9:45

Release of mutator activity following hybridization has been demonstrated in natural population male recombinant (MR) lines of D. melanogaster. Mutator activity in these lines causes an increase in gene mutations and in two lines, where it has been examined in detail, an increase in chromosome breakage. These lines were scored cytologically for breaks in spermatocytes. In this study marked-Y chromosomes were used to genetically assay for chromosome breakage in four lines: OKL, W8D, and TOO7, which are MR lines, and Canton-S (CS) a non-MR control line. Male recombination and mutator activity are only observed in male progeny following crosses between MR males and females of another line (test cross). The hybrid progeny of females from a MR line and males of a non-MR line (reciprocal cross) do not show these events. By using a stock in which both males and females carried the B<sup>S</sup> y y<sup>+</sup> marked-Y chromosome it was possible to obtain F<sub>1</sub> hybrid males carrying this chromosome from both the test or reciprocal cross. These males were then mated with C(1)DX,ywf females and male progeny were scored for loss of y, B<sup>S</sup> or both markers. It was also possible to score for X breakage occurring in hybrid males.

All three MR lines showed significantly greater frequencies of spontaneous X and Y breakage in the test cross than in the reciprocal cross. The CS non-MR did not show this reciprocal cross effect. All MR lines also showed significantly higher X and Y breakage than that observed in the CS line and in a marked-Y laboratory stock. Our results show that increased chromosome breakage is a common characteristic of natural population MR lines in D. melanogaster.

DIFFERENCES IN EXPRESSION AT 18°C OF TWO HOMOZYGOUS CUBITUS INTERRUPTUS LINES (*ci ey<sup>R</sup>/ci ey<sup>R</sup>*) OF *DROSOPHILA MELANOGASTER* SELECTED FOR INTERMEDIATE AND HIGH LEVELS OF FOURTH VEIN ( $L_4$ ) LOSS. Ver1 L. House, Department of Genetics, The OHIO State University, Columbus, Ohio 43210.

10:00

Studies at 18°C with  $L_5Y_1$  and  $H_4Y_1$  lines indicate an approach to dominance of the  $H_4Y_1$  line at the lower temperature in contrast to the relationship between the two lines at 28°C where  $F_1$  progeny are intermediate. This change in dominance relationships results from a non-linear relationship between changes on the genotypic and phenotypic scales. Previous studies have demonstrated that changes on the genotypic scale necessary to eliminate the first 50% of  $L_4$  is three to two times that necessary to span the thinning class, and that the genotypic change needed to eliminate the final 25% of  $L_4$  is twice that necessary to reduce  $L_4$  from 50% to 25% presence. The current study characterizes in greater detail the relationship between genotypic and phenotypic change. Parental,  $F_1$ ,  $F_2$ , and backcross progeny involving the  $L_5Y_1$  and  $H_4Y_1$  lines were cultured at 18°C and the percentage of  $L_4$  presence was measured to the nearest 5%. The data establish that equivalent degrees of change are needed on the genotypic scale to eliminate the first and second 25% of  $L_4$ ; that a 1.61 greater change is needed to reduce the vein from 50% to 25%; that a 1.34 greater change is needed for the next 15% loss; a 1.36 greater change for the next 5% loss; and that a 1.95 greater change is needed to eliminate the final 5% of the vein as compared to that needed to reduce the vein from 10% to 5% presence.

CYTOGENETIC ANALYSIS OF HOMOSEQUENTIAL SPECIES OF HAWAIIAN *DROSOPHILA*. Jong Sik Yoon, Department of Biological Sciences, Bowling Green State University, Bowling Green, Ohio 43403.

10:15

Cytogenetic studies of homosequential species were carried out in four species of the endemic Hawaiian *Drosophila*; two species (*D. gymnobasis* and *D. sivarensis*) belonging to the picture-winged species group and the others (*D. mimica* and *D. kambysellisi*) to the modified-mouthparts species group.---In these studies, I further illustrate the variable features of both polytene and metaphase chromosomes within these "homosequential" species. Furthermore, I demonstrate changes in genetic regulations during development, and discuss the possible role of homosequential species in chromosomal evolution and speciation. (Supported by NSF Grant DEB 78-23661).

10:30 BUSINESS MEETING

## K. GENETICS AND CELL BIOLOGY

FIRST AFTERNOON SESSION

228 KAUKU HALL

PETER H. CALCOTT, PRESIDING

GENETIC VARIABILITY AND SIMILARITY OF FOUR SUBSPECIES OF *NEAPHAENOPS TELLKAMPFI* (COLEOPTERA : CARABIDAE) George D. Brunner, Dept. of Biological Sciences, Univ. of Cincinnati, Cincinnati, Ohio 45221.

1:30

The blind cave restricted (i.e. troglotic) carabid species *Neaphaenops tellkampfi* has an extensive range in the caves of west central Kentucky. Barr (1979) has recognized four subspecies based on morphological and geological criteria. Using polyacrylamide gel electrophoresis, I have measured genetic variability within and genetic similarity among these four subspecies.

Three of the subspecies, *N.t.tellkampfi*, *N.t.henroti* and *N.t.meridionalis*, show levels of heterozygosity ( $H=0.10-0.17$ ) and polymorphism ( $P=0.50$ ) equivalent to those occurring in similar surface inhabiting invertebrates. These values are somewhat unexpected as many cave dwelling invertebrate species show much lower levels of heterozygosity ( $H=0.02-0.048$ ) and polymorphism ( $P=0.08-0.154$ ). Data for *N.t.viator* suggest that it is less genetically variable than the other three subspecies.

The phosphoglucose isomerase (PGI) locus has been particularly useful in examining genetic similarity and gene flow among the subspecies. Three variants have been uncovered at this locus with *meridionalis* populations fixed for a slow migrating form, *viator* populations fixed for a form with intermediate mobility, and both *tellkampfi* and *henroti* fixed for a variant coding for a fast migrating protein. One polymorphic population, containing both the fast and slow migrating variants, has been found. This population is also morphologically intermediate for *meridionalis* and *tellkampfi* characteristics.

ELECTRON MICROSCOPIC STUDIES OF CHROMOSOME REARRANGEMENTS. Margot Kaelbling and Nathan S. Fehhheimer, Department of Genetics, The Ohio State University, Columbus, OH 43210.

1:45

Electron microscopy enabled us 1) to revise the classification of structural rearrangements of chromosomes in the domestic chicken (*Gallus domesticus*), 2) to examine synapsis in heterokaryotypes, and 3) to construct an idiogram. The aberrations had been created by X-irradiation of semen and classified by light microscopy (LM); they have been maintained in stocks. Synaptonemal complexes (SC's) in whole mount spreads from 42 cockerels were used here to study the aberrations. It is shown that in chicken, as was shown by others in several mammals, in some species of grasshopper, and in maize, the relative length of a SC is similar to that of its mitotic and its meiotic chromosome and that the centromere position of a SC corresponds to that of its mitotic chromosome. The mechanism of a centric fission is shown to be a reciprocal translocation involving the entire long arm of a #1 chromosome and the distal 39% of the long arm of a microchromosome. Five translocations which originally appeared non-reciprocal by LM are reciprocal and the translocation points are identified. In a presumed pericentric inversion, no inversion loops had been seen by LM in 128 pachytene nuclei and it appeared that no crossing-over occurs in the region of the inversion. It is confirmed here, that the aberration is the result of a pericentric inversion and not of a 3-break translocation. Inversion loops are present in three of 13 heterokaryotypic #2 bivalents, nonhomologous pairing is seen in 10. An idiogram from six complete SC spreads revealed a graded series of SC lengths with a 30-fold difference from the #1 to the #38 SC.

FLUORESCENT STAINING STUDIES OF THE MIXING AND SEGREGATION OF MITOCHONDRIAL DNA IN YEAST ZYGOTES. Rosemary Dietrich and C. William Birky, Jr., Department of Genetics, The Ohio State University, Columbus, Ohio 43210.

2:30

A dumbbell-shaped yeast zygote forms by fusion of two parental cells of opposite mating type. The first bud often forms at the region of fusion of the two parental cells (central bud). It is known that the mitochondrial DNA's (mtDNA) of the two parents mix because they recombine. But 6-46% of central buds produce progeny with marker genes from only one parent, suggesting they receive mtDNA from only one. We observed the movement of mtDNA throughout the zygote and into the bud directly. Unsynchronized matings were done of a wild type ( $\rho^+$ ) strain of *Saccharomyces cerevisiae* and a petite ( $\rho^0$ ) strain lacking mtDNA. The zygotes, some unbudded and some with their first central bud, were stained with 4,6-diamidino-2-phenylindole (DAPI), a DNA-specific fluorescent stain. The mating of 1-2/3  $\rho^+$  X D6  $\rho^0$  and the reciprocal cross were each done four times and 906 unbudded and centrally budded zygotes were examined. Of 379 unbudded zygotes, 48-84% had  $\rho^+$  mtDNA on the  $\rho^0$  side of the zygote; this increased to 56-96% by the time the first central bud appeared. Unexpectedly, all large central buds contained mtDNA. This observation, and the absence of genetic markers from one or the other parent in the progeny of many central buds, can be reconciled in two ways: (1) in a  $\rho^+$  X  $\rho^+$  cross, the mtDNA from one parent may exclude the mtDNA of the other parent from entering the bud; or (2) in a  $\rho^+$  X  $\rho^+$  cross, all central buds get mtDNA from both parents, but random drift of allele frequencies eliminates markers from one parent. (Supported by NIH grants GM19607 and GM21896.)

CHROMOSOMAL NUMBER OF *PLASMODIOPHORA BRASSICAE* WORON.

James P. Braselton, Department of Botany, Ohio University, Athens, OH 45701

2:45

The nuclei of *Plasmodiophora brassicae* and other members of the Plasmodiophorales are so small (2-4  $\mu$ m diameter) that accurate counts of chromosomes cannot be made with light microscopy. Previous investigators, however, have shown that by counting the number of synaptonemal complexes (SCs) in pachytene nuclei of meiosis I, the haploid chromosomal number can be determined. In this study, transmission electron microscopy of serial thin sections was used to determine that 20 SCs occur in pachytene nuclei of *P. brassicae*. Analysis was made on three nuclei, each from a different plasmodium. Lengths of the SCs, description of modified regions of SCs, distribution of telomeres on the inner surface of the nuclear envelope, and nuclear volumes complete the ultrastructural karyotype. Supported in part by a grant from the Ohio University Research Committee.

CYCLIC AMP ANALOGS AS INHIBITORS OF CYCLIC AMP-PHOSPHODIESTERASE IN DICTYOSTELIUM DISCOIDII. Sandra L. Dutton, Mercedes Gaicias, Peter J. M. Van Haastert and Robert T. Heath. Leiden University, Leiden, Netherlands and Department of Biological Sciences, Kent State University, Kent, Ohio 44242.

3:00

The ability of synthetic cAMP analogs to bind to the active sites of cAMP-phosphodiesterase on the membrane of Dictyostelium discoideum was investigated. Cyclic AMP analogs employed contained modifications in the nitrogenous base; a) cNMP (4-carbon modification), b) cBMP (six member ring modification), c) cC<sub>8</sub>N<sub>3</sub>MP (8-carbon modification) and d) cC<sub>2</sub>N<sub>3</sub>MP (2-carbon modification). Also an analog modified in the ribosyl moiety, 2'-DAM-cAMP (2'-carbon modification), was studied. Binding of these analogs to the active site was determined through demonstrations that illustrated that they act as competitive inhibitors of <sup>3</sup>H-cAMP binding. We showed that base modifications allowed binding of the cAMP analogs to the active site but with a lower affinity than cAMP. Modification of the ribosyl moiety appeared to prevent entry of the compound into the active site.

ULTRAVIOLET LIGHT INDUCED DNA-TO-PROTEIN CROSS-LINKAGE IN BACTERIOPHAGE T<sub>4</sub>BO<sub>1</sub><sup>r</sup>. T. Sawyer and L. Glatzer, University of Toledo, Toledo, Ohio 43606

3:15

In order to determine whether (or not) DNA-to-protein cross-linkage occurs as a lesion under the influence of biologically significant levels of ultraviolet light (254 nm), purified <sup>3</sup>H-Tdr or <sup>14</sup>C-amino acid-labeled T<sub>4</sub> bacteriophage were irradiated, extracted, and analyzed for evidence of intermediate density peaks on CsCl gradients. Extraction of phage with 2% sarcosyl at 100°C for 2 min results in the recovery of DNA and protein at their expected positions in the gradient. When phage were irradiated at 3600 ergs/mm<sup>2</sup> (~6xLD<sub>99</sub>), qualitative evidence of intermediate density material was obtained. At 36,000 ergs/mm<sup>2</sup>, quantitative flotation of DNA and concomittant sedimentation of protein was observed. When post-irradiation mixed-extracts of <sup>3</sup>H-Tdr and <sup>14</sup>C-amino acid labeled phage were sedimented to equilibrium, the intermediate density peaks were coincidental, demonstrating the formation of a stable DNA-protein complex. Confirmation of covalency is provided by isolation and subsequent digestion of this complex with either pronase or nuclease. This results in banding of DNA and protein at their normal densities. Under identical conditions, untreated complex rebands at intermediate density. When high-dose irradiated whole phage are first repurified and then extracted, the counts are initially recovered in whole phage, but, following extraction, an intermediate density peak is found again. This indicates that the crosslink event must occur within intact particles and not with DNA presumptively released by UV-induced disruption or ejection. Since crosslinking is barely detectable at 6xLD<sub>99</sub>, the stoichiometry of in situ DNA-to-protein crosslinkage is apparently insignificant at biological doses in bacteriophage T<sub>4</sub>.

CHARACTERISTICS OF ERWINIA STEWARTII PLASMID pDC250 CONTAINING BACTERIOPHAGE Mu cts pf7701 AND Tn10 INSERTIONS. Sally McCammon, David Coplin, and Robert Rowan, Dept. of Plant Pathology, Ohio Agricultural Research and Development Center, Wooster, OH 44691

3:30

The Erwinia stewartii plasmid pDC250 is derepressed for conjugal transfer. After transfer to Escherichia coli, this plasmid was labeled with the tetracycline resistance (TcR) transposon Tn10 and designated pDC251 and then with the kanamycin resistant (KmR) derivative of bacteriophage Mu cts, pf7701, and designated pDC251.1. In E. coli pDC251.1 was stable and transferred TcR and KmR at a frequency of 0.5%. However, when pDC251.1 was transferred to E. stewartii, it was unstable; loss of either drug resistance markers or the plasmid occurred. 8/13 stable TcR KmR transconjugants contained autonomous pDC251.1 DNA as indicated by agarose gel electrophoresis. When TcR was selected, 90% of the transconjugants contained plasmids with pf7701 excisions. Three clones with possible Tn10 insertions into the chromosome were found. Selection for KmR transfer resulted in 94% of the transconjugants containing no new plasmid, indicating possible transposition of pf7701 onto the chromosome and subsequent plasmid loss. There was a 30-fold increase in the appearance of 2-deoxygalactose resistant mutants among KmR transconjugants, suggesting that pDC251.1 may be useful for generating Mu-induced mutations in E. stewartii.



ULTRASTRUCTURAL AND BIOCHEMICAL CHANGES IN ESCHERICHIA COLI INDUCED BY CYTOSKELETAL ACTIVE DRUGS. Peter H. Calcott, David Morton, Din A. Ghani, Rita S. Petty, Micki Thomas and Keith Knisley, Department of Biological Sciences, Wright State University, Dayton, Ohio 45435

3:45

Three cytoskeletal active drugs, cytochalasin B, colchicine, and vinblastin, were tested for their ability to disrupt vital processes and ultrastructure in Escherichia coli. To allow entry of the drugs into the otherwise impermeable cells, the bacteria were frozen-thawed in the presence of the drugs. A dose-dependent loss in viability was obtained for each drug after a single freeze-thaw cycle in water but not saline. At concentrations sufficient to kill the bacteria, cytochalasin B, but not colchicine or vinblastin, inhibited DNA synthesis, whereas colchicine and vinblastin, but not cytochalasin B, inhibited protein synthesis directed by cytoplasmic ribosomes. All three drugs inhibited RNA synthesis. Freezer-thawing in water, saline or in the presence of the drugs, caused characteristic disruptions of normal ultrastructure. In general, these treatments produced changes in the granularity of the cytoplasm and distribution of the nucleoid.

These biochemical, ultrastructural and viability data suggest a structural organization for bacterial cytoplasm and nucleoid which is required for basic cell function and growth. It is possible that the cytoplasm structure could be due to the presence of procaryotic equivalents of eucaryotic microtubules, microfilaments and microtrabeculae.

This research was supported by US Army Dept. of Research (Grant No. DRXRO-CB-15525-L).

HUMAN CARCINOMA CELL CULTURE ASSESSMENT OF ANTI-TUMOR DRUGS. Mark T. Wininger, Vicki L. Wininger, and William D. Ross, Monsanto Research Corporation, Station B, Box 8, Dayton, OH 45407.

4:15

A highly sensitive clonal cytotoxicity assay using KB human carcinoma epithelial cells has been developed to determine both initial killing and inhibition of cell division as shown by loss of colony forming ability. Currently used chemotherapeutic drugs and candidate drug materials derived from natural plant sources were tested and found to cause varying levels of toxicity at a concentration as low as 10 picograms ( $10 \times 10^{-12}$ ) of extremely toxic compounds such as maytansine. Results of clonal toxicity tests were compared with whole animal toxicity data. Crude extract mixtures of materials derived from plants were separated by thin layer chromatography. Chromatographic plates were then placed on an agar overlay over cells to rapidly screen for "hot spots" of anti-KB activity from the separate fractions of materials. Using these procedures, previously overlooked isomers and derivatives were found to have high KB cell killing ability. Studies were performed to detect differences in clonal cytotoxicity of drugs with KB human carcinoma and with Detroit D98S semi-normal human epithelial cells in an attempt to determine a therapeutic index of effectiveness.

(Samples were obtained through NCI Contract No. 1-CM-33709 and 1-CM-67046.)

## L. MATH AND COMPUTER SCIENCE

FIRST MORNING SESSION

204 TAYLOR HALL

GARY L. DUKE, PRESIDING

### Special Note

In addition to papers presented in this section, many papers dealing with applications of math and computer sciences are scheduled for other sections. See especially the following: B. Plant Sciences - Strom and Wistendahl; E. Physics and Astronomy - Tveekrem et al.; G. Chemistry - Coldiron, Tiernan, Taylor, Carraher; K. Genetics & Cell Biology - Miller and Killian; N. Junior Academy - Blain; Q. Economics - Brody, Eichel; R. Ecology - Bourgeron.

THE EFFECT OF MODE OF PRESENTATION ON ATTITUDES TOWARD AND ACHIEVEMENT IN COLLEGE-LEVEL REMEDIAL MATHEMATICS. Ronald J. Harkins, Assistant Professor of Mathematics, Miami University, Hamilton, Ohio 45011.

8:45

This doctoral dissertation study was designed to examine the effect of mode of presentation (individualized tutorial, small-group, lecture) on achievement in remedial mathematics offered at the college level. Possible explanation of differences in achievement under these three modes due to influences of sex, age, mathematics attitude/anxiety level, or frequency of class attendance were also investigated. Secondly, this study examined possible changes in anxiety and/or attitude toward mathematics over the period of one semester for the different modes of presentation. Attention to the effects of mediating variables such as sex, age, and class attendance was also incorporated into these examinations. Finally, since the remedial program of study operated under a mastery learning philosophy, this study investigated the effects of the mode of presentation on criterion mastery time for a unit in remedial mathematics.

The study involved 76 Basic Algebra students at Indiana University, Bloomington, and was conducted over the Spring 1980 Semester (16 weeks). Twenty hypotheses were statistically tested using analyses of variance/covariance procedures. The study provided evidence that the individualized tutorial format was more effective for low anxiety students, while the lecture mode was more effective for high anxiety students of remedial algebra. Furthermore, the individualized tutorial format was more effective in lowering mathematics anxiety in males while the small-group technique was more effective in anxiety reduction for females.

A PROGRAM FOR A SECONDARY MATH METHODS CLASS FOR FIELD AND CLINICAL/DIAGNOSTIC EXPERIENCES INCLUDING PROGRAM WRITING FOR THE MINICOMPUTER. Dr. Joy S. Lindbeck, College of Education, The University of Akron, Akron, Ohio 44325.

9:30

To meet the guidelines of the State of Ohio Teacher Education Redesign over fifty hours of field and clinical/diagnostic activities in the form of modules were developed for a secondary math methods class. The modules were submitted to a committee of math supervisors, teachers, and a student teacher for critical review. Activities ranged from writing a program in basic for the teaching of a concept with the use of a minicomputer to completing an Individualized Education Program format in mainstreaming. A selected core of required activities and a list of options from the resulting modules were implemented in the fall of 1980. Student preferences, achieved goals, and problems will be presented.

#### ON WOODALL NUMBERS

9:45 Ray Steiner, Mathematics Dept., Bowling Green State University 43403

Let  $C_n = n^{2^n} + 1$  be the Cunningham numbers and  $W_n = n^{2^n} - 1$  be the Woodall numbers. Then  $C_n$  and  $W_n$  are called Cullen numbers.

In NUMBER THEORY TABLES by Bro. Alfred Brosseau, Edgar Karst has given a table of factorizations of  $C_n$  and  $W_n$ . His table is complete for  $C_n$  with  $n$  less than 62 and for  $W_n$  with  $n$  less than 51. In this paper we extend Karst's table for  $W_n$  to  $n = 101$ . All factorizations were done by computer, using a partial converse of Fermat's little theorem, Pollard's Rho method and SQUFOF.

#### THE USE OF FINITE AUTOMATA IN SOFTWARE DEVELOPMENT

10:00

Gary L. Duke, Systems Engineering - Dayton  
NCR Corporation, Dayton, Ohio 45479

Finite automata theories provide a design engineer with several tools which assist in the design of "finite-state machines". Many aspects of finite-state machine design are similar to certain software design problems; however, these theories are not widely used in software development.

This paper discusses some of these tools and presents examples of their possible use in software development. The intent is not to convince you that all software should be designed using these methods but to present alternate methods and to stimulate thinking about the wider use of these methods in software design.

10:30 BUSINESS MEETING

# M. PSYCHOLOGY

FIRST MORNING SESSION

26 KAUKA HALL

PAUL PANEK, PRESIDING

## THE SYMBOLIC WORLD OF RESOURCES

Richard J. Galligan and Darwin L. Thomas, Center for Family Studies, 215 Schrank Hall, The University of Akron, Akron, Ohio, 44325

8:30

Societies are constantly concerned with insuring or increasing the resources they need to maintain their quality of life. Scarce resources are usually thought of as products or features of the earth that are used by Man. However, if we assume that an individual is born into an ongoing social world which provides broad outlines for what is real, that the symbolic world was created and is changed through human interaction, and that a given resource is defined as such only within the context of a symbolic world, then a simple consideration of available resources becomes problematic. History demonstrates that resources used in past societies are no longer utilized, and suggests that our current resources will be superceded in the future. The failure to appreciate the problem-solving potential of human behavior has repeatedly led to errors in resource projection. A serious unintended consequence of these forecasts, which are reasonable within the context of the current world-view, is that they tend to rigidify the symbolic perspective and mitigate against change. Thus, we prefer to emphasize the creative dimensions of humanity. We define resources as those features and products of physical and social reality which are identified and defined by Man's symbolic world as being necessary for sustaining life and satisfying human needs. Implications of the definition for a post-industrial society are discussed.

RIGHT HEMISPHERIC DOMINANCE IN SPATIAL ORGANIZATION. Nancy S. Darr, Austin Manor, Ohio Wesleyan University, Delaware, OH, 43015, and Ralph F. Darr, The University of Akron, Akron, OH 44325.

8:45

The cerebral hemispheres appear to be functionally asymmetrical with the left hemisphere dominant in verbal functions and the right hemisphere dominant in non-verbal functions such as mathematics and spatial organization. The purpose of this study was to determine right hemispheric dominance in a task requiring spatial organization. Forty blind-folded, right-handed subjects were given a task requiring tactile spatial organization. It was expected that the subjects would be able to complete the task more rapidly with the left hand than with the right hand because tactile and motor nerve pathways are contralateral. Therefore, pathways from the left hand directly innervate the right cerebral hemisphere. However, no significant differences were found between the times required to complete the task with the left hand and the times required to complete the task with the right hand. The discrepant results are likely due to the conflicting effects of motor coordination and verbalization of the task.

AUTOMATIC PROCESSING IN PERCEPTUALLY SKILLED AND UNSKILLED SUBJECTS. Harry W. Eberts, Dept. of Psychology, College of Wooster, Wooster, Ohio, 44691.

9:00

The development of a visual perceptual skill called automatic processing was studied in 12 college students (6 "skilled," 6 "unskilled") to determine whether athletic ability in sports requiring rapid perception underlay its acquisition. Automatic processing does not demand attention, is stored in long-term memory, and requires an appreciable amount of consistent training to develop fully. The skilled Ss were members of the college baseball team; the unskilled had no competence or experience in sports that require rapid perception skills. The present study resembled two experiments done by Schneider and Shiffrin (1977), each using a visual field consisting of four letters situated in a quadrant around a central fixation dot. Exp. 1 used a videotape filmed from the screen of Tektronics cathode ray scope. A target letter appeared immediately before the rapid succession of 12 frames (termed a trial). The S's accuracy was measured in identifying which quadrant the target appeared (one in every trial). Exp. 2 used a Harvard tachistoscope. The S's response time was measured for the correct identification of the presence or absence of a target in a single frame (targets appeared on half the trials). Half the trials were consistent mapping (targets were never used as distractors); the other half were varied mapping (targets were also used as distractors). Automatic processing would only develop through consistent mapping due to its single-letter training. It was hypothesized that the skilled group, due to their previous athletic training, would develop automatic processing after four 1-hour sessions, and the unskilled would not.

EFFECTS ON SKILL LEARNING OF VERBAL MEDIATION TRAINING USING MODELING.  
Ralph O. Blackwood and Thomas Ferkol, Department of Educational  
Foundations, University of Akron, Akron, Ohio 44325

9:30

Studies of skill learning have shown that, in a tutorial setting, subjects learn more by practicing, not the gross motor response, but the mediating verbal self cues. However, in large-group instruction, supervised individual practice is seldom feasible, so demonstration (modeling) is often used. An experiment was designed to test the hypothesis that skill learning is more effective if the verbal self cues, rather than the gross motor responses, are modeled. Subjects, 48 sixth-grade boys and girls, were taught perspective drawing. In a treatments by blocks factorial design controlling for IQ, they were randomly assigned to two treatments (mediation training and traditional training) within each of three IQ levels (high, medium, and low). In the traditional treatment, after a teacher demonstration, a student performed the skill in front of the class while the teacher gave verbal cues. In the mediation training, after the demonstration, a student talked the teacher through the task. Two dependent variables were measured: recall and transfer. In the recall test, subjects drew the same object used in the demonstration; in the transfer test, a differently shaped object. The test scores consisted of number of errors. Mediated modeling proved more effective in both recall and transfer ( $p < .01$ ).

DESCRIBING AND PROMOTING COGNITIVE GROWTH THROUGH EXPERIENTIAL LEARNING ACTIVITIES  
M. Kay Alderman. University of Akron, Akron, OH 44325.

9:45

The purpose of this study was (1) to describe the cognitive processes in analyzing concrete, experiential learning activities; (2) to facilitate the use of abstractions from the experience. An experiential learning cycle which begins with concrete data, proceeds to reflective observation, to abstraction of principles and to application to new situations was used by students in undergraduate educational psychology to analyze concrete learning experiences. A content analysis coding system was developed to analyze the data. The study found that 43 percent of the sample initially made abstractions. After feedback and more explicit directions, the number making generalizations increased to 78 percent. It was found that students describe activities on two levels. Level one is overt description of activities while level two is metacognitive description.

EFFECTS OF COGNITIVE STYLE ON PREFERENCE FOR STIMULUS COMPLEXITY ACROSS THE LIFE-SPAN.  
G. Thomas Satterfield and Paul E. Panek, Department of Psychology, Eastern Illinois University, Charleston, Illinois 61920.

10:00

Experimental investigations of preference for stimulus complexity with humans have been generally restricted to the early part of the life-span, i.e., newborns to early adulthood; and, excluding the older adult. These investigations suggest there is a relationship between levels of stimulus complexity and rated preference which is manifested as an inverted U-shaped function, with subjects exhibiting maximum preference for intermediate levels of complexity. Also, it has been suggested that this relationship is age-invariant. This study investigated the effects of age and cognitive style upon preference for 12 levels of complexity (dot stimuli), i.e., 4, 6, 12, 15, 20, 25, 31, 39, 50, 63, 79, and 100 dots. Results indicated there is an age-invariant preference for stimulus complexity across the life-span which is not affected by cognitive style.

PROBLEMS IN THE MEASUREMENT OF THE DEVELOPMENT OF SELF CONCEPT IN AN ACCIDENT VICTIM R. Gandee, R. Deitchman, J. Porterfield, A. Narraway, M. Winningham, and I. Newman. The University of Akron, Akron, Ohio 44325, Akron City Hospital, Akron, Ohio 44308, Cuyahoga Falls General Hospital, Cuyahoga Falls, Ohio 44221

10:30

In the rehabilitation of permanently injured accident victims and chronically ill, the development and maintenance of self esteem or self concept remains a critical factor. In the human performance and work physiology laboratory, the physiological aspects of exercise and conditioning routines in a rehabilitation program are currently quantifiable in an objective manner, while the unbiased evaluation of the associated self-concept remains to be ascertained in valid and reliable manner. The purpose of this paper is to discuss the problems encountered when a healthy, young amputee's use of extended exercise conditioning engage in wheelchair marathon racing and the attempt to relate this to the subject's self concept. The physiological results of this extended arm training were demonstrated by an aerobic capacity during maximal arm exercise as depicted by the elevated values for  $\dot{V}O_2$  max 4.21/min. (STPD) and 64.6ml/kg-min. (STPD). The elevated isokinetic strength (ft.lbs.) development was depicted for the right and left elbow flexion 48 and 57, elbow extension 47 and 40, shoulder flexion 56 and 57, and shoulder extension 103 and 99, respectively. Through these activities, this amputee gained public recognition. The problem that remains for the researchers is the development of techniques which would allow for the adequate measurement of this individual's self concept and personal perception in a reliable manner.

MORAL JUDGMENT AND PERSONALITY IN ADULT OFFENDERS. James E. Kantner, Department of Psychology, Eastern Illinois University, Charleston, Illinois 61920.

10:45

This study investigated the relationship of moral judgment stages and personality variables in a group of incarcerated male offenders. On the basis of their scores on Rest's Defining Issues Test, an objective measure of Kohlberg's moral development theory, a total of 159 inmates comprised five moral judgment groups. Dependent measures included Levenson's multidimensional locus-of-control scale and the Psychological Screening Inventory. Results indicated differences among the groups in Internality and Chance as well as Alienation and Expression. In addition, the moral judgment level of inmates was found to be exceedingly underdeveloped. Implications of the utility of basing treatment interventions of law violators on moral judgment theory is discussed.

## M. PSYCHOLOGY

FIRST AFTERNOON SESSION

26 KAUK HALL

ROBERT GANDE, PRESIDING

STUDENT SATISFACTION USING DIFFERENT METHODS OF PRESENTING THE STRONG-CAMPBELL INTEREST INVENTORY. Dawn Diezman Lord, PhD; Mark Miller, PhD; & Jon Thomas, PhD. Fallsview Psychiatric Hospital, 330 E. Broadway, Cuyahoga Falls, Ohio 44221

1:30

Since accurate reporting of test results is associated with an effective counseling process, it is important that such information be understandable, precise, meaningful, and appropriate. As a result, the relative effectiveness of three methods of test reporting (audio-visual, counselor-only, and a combination) of the Strong-Campbell Interest Inventory (SCII) was compared to a control group receiving a traditional written report. Results using analysis of covariance showed all three experimental groups as more accurate in recall of test information and higher in student satisfaction than the control group. The possible use of an audio-visual device as an effective approach for reporting and disseminating test information was discussed.

THE TEACHING STYLE OF THE COOPERATING TEACHER AS A PREDICTOR OF CONFERENCE STYLE.  
Alice Dozier Darr, 109 Nixon Hall, Kent State University, Kent, OH, 44242 and  
Ralph F. Darr, The University of Akron, Akron, OH, 44325.

1:45

This study was designed to determine if cooperating teachers use a similar or different verbal interaction style when teaching their classes and when holding post observation conferences with their student teachers. Seventeen cooperating teachers, in elementary and secondary schools, completed at least one audio tape of themselves teaching a class and one of a post observation conference with a student teacher. Tapes of the teaching were coded by a trained observer using the Flanders Interaction Analysis System and conferences were coded using the Blumberg System of Conference Interaction Analysis. A combined system was developed using parallel categories from each system. The combined categories included three of indirect behavior and two of direct behavior. Means, standard deviations, and correlations between the conference and the teaching sample were computed using percentages of total conference rather than raw scores. Significant positive correlations were found for praise and silence. Significant negative correlations were found for presenting information and student talk. Data from this research facilitates effective placement of student teachers.

WHAT RESEARCH SHOWS ABOUT HUMANISTIC TEACHING BEHAVIORS THAT REDUCE STUDENT  
DISCIPLINE PROBLEMS Walden Crabtree The University of Akron, Akron, Ohio 44325

2:00

Theory and research on teaching are currently the object of much study, and recent findings in this area will undoubtedly be of use to the Ohio Teacher Redesign program, which seeks to improve teacher education in the State of Ohio. One of the goals of the Ohio Teacher Redesign Program is to get teacher educators in Ohio to teach pre-service teachers certain competencies to control deviant pupil behavior in the classroom. But, are there teacher behaviors which valid research has shown to be effective in reducing negative student behaviors in classrooms? Research showing operant conditioning to be effective in managing student behavior is plentiful, but a certain skepticism exists apropos of so-called humanistic variables, because of the alleged lack of specificity associated with this type of teacher competency. In light, however, of the strong interest in humanistic variables that persists, for various worthy reasons, in the literature, it is important for teaching theory and for educational practice to examine how such claims regarding humanistic variables fare, when examined by stringent empirical criteria. By reference to the results of studies and of conclusions of specialists in the field, by summarizing empirical studies indirectly related to the question under inquiry, and by summarizing studies that were very directly related to the question under study, it was found that certain specifiable and measurable humanistic teaching behaviors were effective in producing student achievement, including reduction of negative behaviors, and that these skills can be taught to teacher trainees.

EFFECTS OF STRUCTURE ON PERCEPTIONS OF COUNSELOR EFFECTIVENESS. Dawn Diezman Lord,  
PhD. Fallsvew Psychiatric Hospital, 330 E. Broadway, Cuyahoga Falls, Ohio 44221

2:15

This study investigated perceived counselor effectiveness as influenced by both the amount of structure used by the counselor and the personality characteristics of perceivers. This was accomplished by showing 133 subjects one of two 11-minute videotapes depicting an initial counseling interview and having them rate the effectiveness of the counselor they observed. The two videotapes differed in the amount of structure used by the counselor, which was the major experimental manipulation. Hierarchical regression analyses were used to determine whether the interaction between the personality tests (Internal-External Locus of Control Scale and Cognitive Structure Scale of the Personality Research Form) and experimental manipulation had significant incremental effects in predicting the perceived effectiveness of the counselor. Results indicated that all research hypotheses were supported using one or more of the counselor evaluation forms. That is, subjects with an internal locus of control perceived the low structure counselor to be more effective while subjects with an external locus of control perceived the high structure counselor to be more effective. Similarly, significant interactions were found using need for cognitive structure and experimental manipulation. Also, a manipulation check indicated that subjects, as well as expert judges, perceived the amount of structure in the videotapes to be significantly different.

NONOBTUSIVE METHODS IN THE TREATMENT OF JUVENILE DELINQUENTS: THE USE OF DAILY LOGS. James E. Kantner, Department of Psychology, Eastern Illinois University, Charleston, Illinois 61920.

2:30

Residential treatment programs for juvenile delinquents have frequently been criticized for their lack of evaluation and effectiveness. In addition, staff subjectivity and inconsistency in administering rewards and punishments are perennial problems within the institution. The present study proposed a conceptual framework for relating institutional behaviors to the rehabilitative mission of the institution and developed an evaluative tool for monitoring residents' behavior. Over a period of about six months, data were obtained from the daily logs of cottages at a midwest state facility for adjudicated male delinquents. The result was a pragmatic, easy-to-use system of program monitoring with both treatment and administrative applicability. Implications of the study are discussed.

PSYCHODRAMA: ACTION-ORIENTED PSYCHOTHERAPY;RONALD J. KLEIN, PH.D.; 329 POWER ST.; AKRON, OHIO 44311.

2:45

An introduction to psychodramatic production techniques, methods and the varied applications within different therapeutic settings will be both discussed and demonstrated. The presentation will examine the following areas: (1) the four primary phases of a psychodramatic session: warm-up, action, sharing and processing; (2) the psychodramatic production techniques that might be utilized within any given session: doubling, role-reversal, role-playing, auxiliary-egos, mirroring, etc.;and, (3) the limitations of the therapy with different target populations. Finally, the benefits that might be derived through staff training will be highlighted: enhanced sensitivity to self and others, spontaneity and creativity, role-flexibility, alternative solutions/strategies to problems and conflict areas, desensitization and cognitive reorganization.

THE CONFOUNDING OF PERCEPTION OF I.Q. ON A MEASURE OF ADAPTIVE BEHAVIOR. Ronald F. Bobner, Carolyn Benz, Isadore Newman, Mary J. Beaubien. Youngstown State University, College of Education, Youngstown, Ohio 44505.

3:30

Teacher perception of a student's I.Q. may bias adaptive behavior measures used for placement in special classes. This study investigated the effect of perceived I.Q. on the Devereux. Fifty-two urban severe behavior handicapped students, grades K-12, were matched for age, race, sex, and I.Q. with students from regular classrooms (total N = 102) from his/her home attendance zone as social and economic control. Regression techniques were used. Rater vectors accounted for rater differences. Results indicate perception of I.Q. accounts for significant variance above measured I.Q. The Devereux may not be an unbiased placement measure.

3:45 BUSINESS MEETING

# N. JUNIOR ACADEMY

Morning sessions will start at 8:30 A.M. A final revised program with specific times will be available at the registration desk. A business meeting is set for 1:30 P.M. in 225-226 Kauke Hall.

## CHILD ABUSE AND ITS EFFECTS ON BEHAVIOR

Christine R. Bianchine

2444 West Lane Avenue, Columbus, Ohio ,43221

Child abuse is the net result of a combination of emotional or physical damage suffered by the abusive individual early in his life, his own genetic makeup and the later environment in which he finds himself as a parent. There are many reasons why parents abuse their children. Some authorities feel there is competition among family members for material needs. Others feel that the combination of alcohol excess, poverty, broken marriages, unemployment, and the family's social and economic status that all contribute to the causes of abuse. Drs. Kempe and Helfer, authorities on abuse psychology, agree these factors play a role in the genesis of child abuse, but also stress that the actual basis for abuse lies much deeper. They have documented evidence showing the cyclic patterns abused children follow to become abusive parents. Drs. Kempe and Helfer also developed three different paths the mind of an abused person follows. They generally become 1) severely depressed and withdrawn from society 2) relatively normal with only slight mental disorders or 3) rebellious against adults and their restrictions. Unfortunately, all of these three branches look grim. According to a girl removed from her abusive family and placed in the Central Ohio Adolescent Center, "after all I have been through with my parents, I would never abuse my children." Sadly enough, her medical records reveal that she has attempted several violent acts against many in contact with her.

## MEMORY EXPANSION OF THE HEATHKIT ET-3400 MICROPROCESSOR TRAINER

Kenny Blain, North High School, 701 East Home Road, Springfield, Ohio 45503

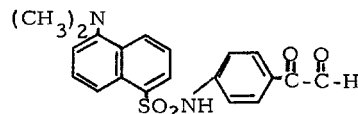
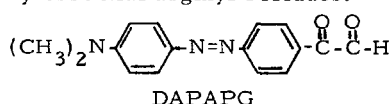
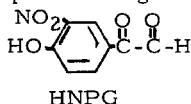
The Heathkit ET-3400 microprocessor trainer, built around the Motorola 6800 microprocessor chip, and programable in hexadecimal machine language, is equipped with 512 bytes of static ram memory. An additional 1024 bytes (1K) of static ram memory was added by altering the existing circuitry and adding the necessary components to support the additional memory and to fully decode it.

## NEW ARGININE REAGENTS. Jean S. Campbell and C. L. Borders, Jr.,

Department of Chemistry, College of Wooster, Wooster, Ohio 44691

Selective chemical modification by phenylglyoxal has shown that arginyl residues are essential components of anion binding sites in numerous enzymes. We have previously synthesized and characterized 4-hydroxy-3-nitrophenylglyoxal (HNPG), a chromophoric analogue of phenylglyoxal which is specific for the modification of arginyl residues in proteins. We have used HNPG to identify Arg-143 as the essential arginyl residue in yeast Cu, Zn superoxide dismutase.

We now report the synthesis and characterization of two new arginine-specific reagents, 4-(4-dimethylaminophenylazo)-phenylglyoxal (DAPAPG) and 4-(5-dimethylaminonaphthalene-sulfonamido)-phenylglyoxal (DANSPG). DAPAPG contains the intensely chromophoric azobenzene moiety and may be a better chromophoric reagent than HNPG. DANSPG contains the strongly fluorescent dansyl moiety and should add a new dimension to the use of arginine-specific reagents to study essential arginyl residues.





EXCORPOREAL DIALYSIS USING PORCINE LIVER IN REYE'S SYNDROME.  
Gerald B. Essenmacher, 298 Michigan Avenue, Elyria, Ohio 44035.

Reye's Syndrome, an often fatal clinical entity of obscure etiology, produces a pathological elevation of blood ammonia in many cases. Subsequently, the ammonia gives rise to cerebral edema, coma and death, this a consequence of metabolic blockage of the liver's urea cycle. Development of a temporary adjunct capable of replacing the compromised liver would give the injured organ a chance to re-establish its own function. Toward this end I looked into the feasibility of using porcine liver, excorporeally linked to a simulated patient. Hog livers were suspended in a physiological saline bath, connected via polyethylene tubing to a roller pump, and perfused with heparinized blood to which measured amounts of ammonium hydroxide ( $\text{NH}_4\text{OH}$ ) was added. The clearance rate of the ionized ammonia was monitored over a period of fourteen hours using a colorimetric procedure on plasma. It was found that ammonia was effectively removed from the blood and that hog liver has the potential for removing the ammonia associated with Reye's Syndrome.

THE EFFECT OF GIBBERELIC ACID ON THE SYSTEM OF ROOTS AND STEMS OF THE VIGNA SAVI  
Edward K. Fugikawa 101 Fairfield Dr. Swanton, Ohio 43558

The purpose of this research is to investigate the effect of gibberellic acid, GA<sub>3</sub>, on the system of the roots and stem of Vigna savi, the common garden pea. Previous research states that treated plants would have longer stems and the root growth and the new root formation would be reduced. This lengthening is caused by elongation of the pea's cells. The effect of GA<sub>3</sub> will cause the stem to elongate and the root growth and new formations of the roots to be reduced. The application of GA<sub>3</sub> could effect this theory. This research will study three types of application (to areas): roots alone, stem alone, and both the roots and the stem. A control group will be used to compare the growth of plants that are grown between newspaper. Everyday, for a ten day period, a specified amount of the growth hormone will be added to the plant and the length of the roots and the stems will be measured.

The results of this experiment indicate that the treatment of the roots only causes the greatest effect on the plant, that is, a very large stem with a small root system. Arguments for the beneficial uses of gibberellic acid are presently under study along with studies of possible growth mechanisms.

Is There A Risk Of Staphylococcal Food Poisoning In Our High School Lunches? ATUL GAWANDE 85 Elmwood Place, Athens, Ohio 45701

Certain strains of Staphylococcus aureus bacteria produce the enterotoxin which causes staphylococcal food poisoning. Symptoms of this disease include nausea, vomiting, and diarrhea. The purpose of this research project is to determine if, and what, foods are vehicles of transmission for the bacteria causing staphylococcal food poisoning and, if it is such a vehicle, how much risk there is. To find out the number of Staphylococcus aureus per gram of the food, the food is diluted, blended, and transferred to mannitol salt agar plates. After forty-eight hours, the bacteria that are round, apparently sold, and have a yellow halo around them are counted. The yellow halo is caused by fermentation of the Phenol Red in the agar. A tossed salad consisting primarily of lettuce is found to be the most likely vehicle of transmission out of the seven foods tested thus far. After finding and counting the bacteria by this method, the bacteria are confirmed to be Staphylococcus aureus by a coagulase test. In the future the foods maybe tested for coliform and fecal coliform counts as well as plate counts on plate count agar, which is now being tried.

For the past two years I have been analyzing the Biochemical Oxygen Demand (B.O.D.) of water samples from Beaver Creek, a small stream originating in Henrietta Township and joining with several ditches, that eventually flows into Lake Erie. Beaver Creek does not have any industrial pollutional matter from its origin to well past the area tested.

I began my studies on Beaver Creek in the spring of 1979. In the summer of 1979 the village of South Amherst, Ohio, installed a storm sewer that flows into the stream. Before the addition of the storm sewer the B.O.D. levels of the stream were low. In the spring of 1980 I investigated the pollutional output of the storm sewer and three drainage pipes upstream, by use of B.O.D. and microorganism tests. My findings showed an increase in the pollutional level of the stream.

I am presently conducting a comparison ecological study on the effects of a storm sewer loading of a stream. A three station set up (before, during, and after) is used to compare the parameters at each station for suspended solids, flow, B.O.D. and phosphate levels. These parameters will help to monitor the effects on storm sewer loading.

My experimentation will continue through February 1981. I have already detected a higher phosphate level. If phosphate pollution continues, the growth of algae will ultimately lead to eutrophication, that is, the complete filling of the stream. Eutrophication is speeded up by phosphate pollution, as well as sewage and soil erosion.

#### CAFFEINE TOXICITY IN MICE

Peggy Goodell, R.R. #3, Bryan, Ohio 43506

This experiment was to determine the effect of excessive caffeine consumption on mice. The study included six pairs of mice of which three pair were given caffeine and three pair were controls. The caffeine given was approximately two-hundred fifty times the amount consumed by the average coffee drinker per day on a per weight basis. The average consumption of coffee is estimated to be fifteen ounces a day. Observations included sociological behavior, reproduction, and histopathological effects on liver and kidneys. Data obtained during the experiment clearly indicated a different sociological behavior between the experimental and control mice. Experimental mice showed less weight gain, more aggression, and increased activity. Results pertaining to the reproduction were equivocal and incomplete due to too few offspring to compare. The most significant results were obtained by comparison of histologic sections of control and experimental animals. Organs were harvested from mice after sodium pentobarbital euthanasia. Microscopic examination was performed by a medical pathologist at a local hospital. Organs examined were the liver and kidneys of parents and offspring of both groups. All control animals revealed normal organs grossly and histologically. Experimental mice showed marked deviation histologically but were normal grossly. Toxicity of both kidneys and liver were evident by the following results: Hydropic degeneration of the kidneys, parenchymal inflammation of the liver as well as bile duct replication. Wide spread degeneration and necrosis occurred in all livers of experimental mice. Microscopic photographs were taken of all histological sections.

#### A CORRELATION OF THE VOLUME OF THE CEREBRAL VENTRICLES TO THE BODY WEIGHT OF DOGS

Hauman, Mark H.

Mark Myers

14242 Reeder Avenue

Alliance, Ohio 44601

The purpose of this study was to measure the volume of the cerebral ventricles of dogs and to correlate the volume with the body weight of the specimen. The volume of the ventricles was determined radiographically or by injecting material which would form a cast in the ventricles.

Mongrel dogs were anesthetized, weighed, and subsequently euthanatized for use in the present research and in medical student training.

After the brains were removed and suitable preparations were completed, the brains were injected with one of several radiographic substances or casting materials. If the casting procedure was employed, a 90% solution of sodium hydroxide (NaOH) was used to dissolve the brain tissue.

The findings of this study support the theory of a standard correlation of ventricular volume to body weight in dogs. The results also indicate that intelligence may partially be determined by the weight of the brain in relation to the weight of the body.

## RECLAIMING CHROMIUM FROM STAINLESS STEEL

by  
Brian P. Higgins  
929 Bexley Drive  
Perrysburg, Ohio 43551

The United States gets 90% of its chromium from other countries. Chromium is a crucial mineral in the production of strong alloys such as stainless steel. This experiment was meant to find a way in which the U.S. could reduce its dependency on foreign countries for key minerals like chromium. One way in which this could be done is by reclaiming chromium from stainless steel. Most razor blades are made of stainless steel. They are practical items from which chromium can be obtained. In this experiment, different razor blade brands were chosen to compare the content of chromium in each. First, these blades were dissolved in hydrochloric acid. Sodium hydroxide was then added. This solution was cooled in an ice bath, and hydrogen peroxide was mixed in. The solution was boiled for 2 minutes. Acetic acid was then added. The solution cooled and was filtered. Lead acetate was mixed with the filtrate in the beaker. This solution was then boiled, cooled, and filtered. The precipitate yielded was lead chromate. The percent of chromium in each razor blade was then calculated.

## PERFORMANCE IMPROVEMENTS FOR HOT AIR SOLAR COLLECTORS, James McAleese, 47149 Bursley Road, Wellington, OH 44090

A great deal of the emphasis on solar energy has been directed at hot water systems which, because of their complexity, require a professional maintenance staff. There has not been enough research in low maintenance hot air systems. In this study the emphasis is directed at hot air systems that would be suitable for home use. The performance of flat bed hot air collectors is examined for various flow configurations such as, flow above, below, or on both sides of the black absorber plate, and for various internal configurations of the black absorber surface such as honeycombs of different sizes and tented screening. Performance and temperature increase are experimentally determined for specific internal and external temperatures and wind speeds. Experimental studies are also performed for a class of slave collectors where the larger outer solar collector is used to reduce the heat losses of the inner solar collector which is used to supply hot air for space heating. Also included is an experimental study to enhance the performance of an evacuated tube hot air collector by the use of strips of mirrors as concentrators in various configurations such as vee, double faceted vee and parabolic arrangements. The performance and temperature increase are determined for angles of the concentrators, various angles of the sun, and different wind speeds. Conclusions are drawn regarding the optimum use of each hot air collector, as well as, the synthesis of a hot air collector system utilizing each of the configurations.

## INFLAMMATION MECHANISMS AND CONTROL OF PROSTAGLANDIN SYNTHESIS IN THE INFLAMMATORY RESPONSE OF ARTHRITIDES. Kelly McAleese, 47149 Bursley Road, Wellington, OH 44090

Through previous experimentation with guinea pigs to determine the 1) spontaneous, 2) salicylate-induced, and 3) ACTH stimulated cortisol secretory patterns, a highly synchronized cortisol rhythm with a predominant periodicity of 35-60 minute intervals was observed following ACTH and salicylate infusion. The persistence of this rhythm suggested feedback was causative and reinforced the concepts of salicylate dependency upon the stimulated release of adrenocorticotropin and the advantageous substitution of salicylates as an alternative to corticosteroid therapy for arthritides. Results also indicated that the probable mode of action for NSAIA (Non-steroidal Anti-inflammatory Agents), that of inhibition of prostaglandin synthesis, does mediate in the prostaglandin cascade and is integral in the role of inflammation as well as normal physiological function. A three-month drug treatment program in dogs is conducted to accumulate evidence on a higher level of vertebrate with circulatory responses more analogous to human reactions. Through simulation of arthritic inflammation diagnostic assays of synovial fluid of acetabuli in salicylate and corticosteroid groups are conducted, analyzed, and compared for effectiveness of salicylate treatment. Radiographs determining the degree of progress of arthritic changes of various affected joints are examined for extent of tissue damage before and after drug therapeutics to alleviate symptomatic findings. Histopathic studies also show suppression of arthritis in dogs treated with prostaglandin  $E_1$  ( $PGE_1$ ) from time of adjuvant injection. Established synovitis is improved and the progression of arthritis and cartilage destruction is halted.

THE EFFECTS OF SALIVARY pH ON TOOTH DECAY  
Shannon O'Donnell, 2730 Ranfield Rd., Mogadore, OH 44260

It is known that bacteria are a prominent cause of tooth decay. It is also known that these bacteria can only grow in an environment in which conditions such as temperature, humidity, and pH are favorable. If the environmental factors are not at an optimum level there may be an inhibition of bacterial growth.

The purpose of my experimentation is to determine whether or not there is a correlation between tooth decay and salivary pH. My procedure will consist of a study of approximately one hundred participants' complete dental histories and saliva pH tests. As a follow up study I will grow cultures from samples taken from participant's and categorize them as being in an environment with either a high, medium or low pH. From these results I will see if there is indeed a correlation between the salivary pH and the number of cavities a person has.

AN ANALYTICAL STUDY OF VARIOUS SULFIDE ELECTRODES. Thomas J. Povsic 604 Knollwood  
Dr. Bowling Green, Ohio 43402

In recent years, many solid state electrodes have been developed and tested. Many of these have been proven to be extremely accurate and reliable. In light of this, lead sulfide and silver sulfide electrodes were tested for response characteristics, selectivity, and sensitivity. These electrodes were chosen because an electrode capable of testing for sulfide ions was desired. The lead sulfide electrode was also chosen because the crystal used in it (Galena) is found freely in nature. Although the lead sulfide electrode showed some common properties common to such electrodes, its calibration curve could not be reproduced. Thus the electrode was abandoned. The silver sulfide electrode proved to be a reliable one, which gave results concurring closely with those predicted by the Nernst equation and spin-offs of that equation.

GLUCOCORTICOID EFFECTS ON SPINAL CORD LIPID PEROXIDATION  
Carrie W. Rinker, 6226 Waterloo Rd., Atwater, Ohio 44201

It has been postulated that lead may be a possible cause of amyotrophic lateral sclerosis (ALS), a degenerative neurologic disease which affects the motor neurons. This hypothesis is based upon data that has been collected from autopsies done on victims of ALS. After analyses of spinal tissues it was found that ALS victims have lead concentrations three times that of the control group. It has also been found that certain steroids, such as the glucocorticoid methylprednisolone decrease lipid peroxidation when administered at optimum dosages.

The purpose of my experimentation is to determine whether the glucocorticoid methylprednisolone decreases the amount of lipid peroxidation in tissue specimens with varying amounts of lead concentrations. If the results are favorable and methylprednisolone does decrease the amount of lipid peroxidation we may find that glucocorticoids have therapeutic applications in the treatment of motor neuron diseases such as ALS.

THE USES OF MEDICINAL PLANTS - PAST AND PRESENT  
Heather Shannon  
Butler Senior High School  
600 South Dixie Drive  
Vandalia, Ohio 45377

The purpose of this project is to explore wild plants and herbs. Medicinal uses of plants in past days, as home remedies, are compared with those of today. Although much of the investigation was carried out by the reading of literature, research in the laboratory was done. A knowledge of plant structure was attempted. By observing the germination of seeds and growth of plants, in the greenhouse, the morphological structure was learned for field identification. A limited survey was compiled, by personal communication, as to the use of home remedies by the population of Montgomery County.

Nonverbal Communication by Liz Sigel 12390 Wandel Rd. Homerville, Ohio ,44235  
Body language is a complex and necessary form of cybernetics. My objectives are as follows; firstly, to establish a set method of deciphering nonverbal cues in context, secondly, once the set method is established, use it to interpret nonverbal communication, and thirdly, compare the nonverbal communication of slow learners to that of normal children on the same age level by applying objectives 1 and 2.

The procedure utilizes video tape equipment which monitors subjects given a controlled stimuli, and the useage of experimental question and evaluation sheets which result in a device to analyze nonverbal communication. Insofar as the results to this date, interpretation of nonverbal communication contains many variable factors which must be isolated to obtain a set method of deciphering cues in context, experiments have confirmed that there is an established pattern of nonverbal communication among subjects involved with a given stimuli.

The results tend to show that there is a great corralation between a person's nonverbal communication and his thoughts.

#### THE EFFECTS OF 1, 3, 7 TRIMETHYLXANTHENE ON RATS

Tamara Simpkins, 1274 Diver Road, Deerfield, Ohio 44411

This experiment will test the effects of caffeine on metabolism and the  $F_1$  generation. The caffeine will be introduced into the water supply of male and female rats, in amounts based on approximations of their weight (kilograms of weight to milligrams of caffeine). After an intake of caffeine for approximately four months, each rat will be tested for oxygen consumption. Then caffeine females will be bred to non-caffeine males; caffeine females will be bred to caffeine males; non-caffeine females will be bred to caffeine males; and another set of caffeine females will be bred to caffeine males. After the gestation period, the  $F_1$  generation will be examined for birth defects. A comparison between this experiment and previous literature research done should show:

1. A definite increase in the consumption of oxygen in the caffeine rats as opposed to the non-caffeine rats.
2. Possible birth defects in all caffeine/non-caffeine  $F_1$  generations, with a possible increase in the birth defects in the caffeine/caffeine  $F_1$  generations.

#### ELECTRONIC CONTROL OF AUTOMATED RESISTANCE WELDERS

Rod Stebelton, 6155 Coonpath Road, Carroll, Ohio 43112

For the past three years I have been working on a solid-state control for resistance welders. I now have several devices which I have designed and built to control the accurate timing sequence required for this process. I have also constructed a miniature spotwelder to test and demonstrate my controls. My timers have only one electromechanical device (a relay) which is used as a safety lock-out device. At the present time I have 12 timers in use at a spotwelding factory. One major problem I incurred with my control was erratic timing caused by the inductive loads placed at the outputs of the timers creating voltage spikes which entered the low voltage supply. I am currently working on a machine and controller to mass produce a small welded item with very little human labor required.

#### EDTA DETERMINATION OF WATER HARDNESS

by

Jeffery A. Sturgill  
1156 Juliet Drive  
Toledo, Ohio 43614

All naturally occurring water has a "water hardness"; that is, a concentration of metal ions dissolved in it. In my experiments, I obtained samples of water, and used the chelate EDTA to titrate the samples for this water hardness. Using two separate methods, a home-made procedure and an industrial procedure, I tested area waters, then compared the results I received to find differences in hardness, relations between stream and well waters, etc. The primary goal was to analyze the samples, then compare the results to find any trends that might be occurring in various parts of the area. In addition to the data that I collected, literature pertaining to water hardness was used to compare my results with those of other experimenters. These papers were also helpful in explaining the mechanics of chelation.

CAN PERCEPTIVENESS IMPROVE THROUGH AN ENRICHED ENVIRONMENTAL STATE?  
Faith Tumeo, 9100 Nichols Lane, Johnstown, Ohio 43031

An extensive amount of experimentation has been conducted with regard to neurological development through the manipulation of environmental living conditions. From previous research, it has been noted that due to enriched environment, a significant number of dendrites accumulate.

My hypothesis: An increase in the number of dendrites leads to the development of additional synaptic connections. In turn, I theorized that the more abundant interneuronal connections are, the less necessary it is to have vast amounts of neurotransmitters released from a telodendria to a dendrite. Why? A certain amount of neurotransmitter is essential to bring about a firing threshold (an active state) in the neighboring cell. If there are fewer synapses, a larger amount of neurotransmitter is required to excite the adjoining nerve cell. Therefore, the increase of dendritic connections leads to an allowed decrease in liberation of transmitters per synapse, while still attaining the firing threshold state.

From this point, it is evident that a smaller stimuli can act on a neuron and produce a reaction in which the following cells are fired. This would allow smaller stimulations to be noticed. In turn, I'm inferring better stimulus reception (perceptiveness) can lead to improved learning. The specimen used was the ceonobita clypeatus/hermit crab. Environmental stimulation was manipulated and all specimens were subject to participate in an operant learning task. To test my theory, a correlation was drawn from data of variance in environment with respect to learning performance and dendrite development.

THE POSSIBILITY OF MAGNETISM AS AN ALTERNATE ENERGY SOURCE. Steven Tumeo, 9100 Nichols Lane, Johnstown, Ohio 43031

My project deals with the conversion of energy from a magnetic to a mechanical form.

I propose that this energy can be generated thru the use of a rotating, spoked mechanism and an accompanying swing bar - both equipped with magnets. A magnetic field is formed by two opposite poles used as apical points on the protrusions from the central axis.

Thru the use of the magnetic flux created by the magnet located on the swing bar as it is brought into the aforementioned magnetic field, I hope to produce a gyration of the axis, causing any connected generator to rotate.

I believe that I have been able to compensate for the higher friction rate and poor construction which could have contributed to the failure of earlier endeavors along this line.

ABNORMALITIES OF THE SYNOVIAL FLUID IN DIFFERENT ARTHRITIC DISEASES. Catherine Vlastaris, Fairview High School, Department of Science, 4507 West 213th St., Fairview Park, Ohio 44126, U.S.A.

The purpose of my study was to see if red and white cell counts and differential cell counts would be helpful in the differential diagnosis of various types of arthritic diseases, since the correct diagnosis is extremely important for the proper treatment. I examined nine specimens of synovial fluid for color, clarity and took red cell counts, white cell counts, and differential cell counts. Of my nine cases, four of them were rheumatoid arthritis, two of them were gout, one of them was degenerative arthritis, and another was both gout and pseudogout. I found that the more severe the inflammatory reaction of the synovium was the higher number of leukocytes in the synovial fluid. I discovered that in my gout and pseudogout cases, most of the cells were polymorphonuclear. I also found a large number of ragocytes or macrophages present in my rheumatoid arthritis cases. In my single case of degenerative arthritis, I found the number of white cells to be relatively small compared to my other cases, and in my traumatic bursitis case, the fluid was bloody. Although white cell, red cell and differential cell counts do not indicate the specific type of arthritic disease, they can be very supportive evidence in making the correct diagnosis.

THE EFFECT OF ADRIAMYCIN ON THE FERTILITY OF MALE RATS. W.P. Whitely, B.F. Giffin, G.A. Bonanni and P.K. Bajpai. Department of Biology, University of Dayton, 45469.

Adriamycin has been shown to be one of the most effective chemotherapeutic drugs currently available. In cell culture studies, adriamycin has been demonstrated to be a causative factor in mutagenesis and chromosomal abnormalities. Because the mode of action of adriamycin is through intercalation with DNA and inhibition of nucleic acid synthesis, it was of interest to determine if male rats treated with this chemotherapeutic drug could fertilize and produce normal offspring. Male Sprague-Dawley rats were put on adriamycin therapy (1.0 mg/kg body weight/week) for eight weeks. Fourteen weeks after cessation of adriamycin injections these animals were mated with females, as were saline-injected control males. Copulation was determined by the presence of spermatozoa in the vagina. Three females from the experimental and control group were sacrificed at 7 and 14 days post copulation. Fallopian tubes were removed and the fetuses were examined for normal implantation. Three animals from each group (experimental and control) were allowed to go to full term. Neonatal pups were immediately sacrificed with ether and observed for abnormalities. Counts of fetuses, pups, weight and body length were recorded. Results of the experiment indicate that male rats treated with therapeutic doses of adriamycin retain fertilizing capacity 14 weeks after treatment. No significant difference between experimental and control groups in regards to fetal weight, body length and numbers of fetuses was found. Rats mated with adriamycin-treated male rats delivered significantly lower number of pups than rats mated with controls. Results of this investigation suggest that fetuses fathered by adriamycin-treated males may undergo spontaneous abortion.

## **O. ENGINEERING**

AFTERNOON SESSION

204 TAYLOR HALL

RUSSELL PRIMROSE, PRESIDING

1:30 BUSINESS MEETING

## **P. ADMINISTRATIVE SCIENCES & PLANNING**

FIRST MORNING SESSION

229 KAUK HALL

MIMI BECKER, PRESIDING

EMERGENCY ALARM RESPONSE SYSTEM: A COST AND COST/BENEFIT ANALYSIS  
William J. Pammer, Jr., Graduate Assistant, Department of Urban Studies, The  
University of Akron, Akron, Ohio 44325

8:30

This paper presents a cost-benefit analysis of the Emergency Alarm Response System operated by Akron Info Line Service. Its purpose is to develop a model to assess whether or not the system is economically justified on the basis of yielding health-care cost containment benefits which exceeds costs of the program to the public sector. It is hypothesized that the E.A.R.S. system could avert increases in the long-term support services for the elderly. Findings include, in order of their presentation, program cost, and economic benefits.

APPLYING THE AGRICULTURAL EXTENSION MODEL TO THE URBAN AND REGIONAL SETTING  
Frank J. Costa, Director, Center for Urban Studies, The University of Akron,  
Akron, Ohio 44325

9:00

Land grant colleges and universities have addressed many of the economic and occupational issues facing rural communities with great success. In recent years many attempts have been made to try to replicate this success in urban and regional or metropolitan settings.

Most urban extension models have met with limited success because the entire rural extension concept or model has not been completely applied. The model includes not only academic programming but also "in the field" activities at agricultural experimental stations.

The purpose of this paper is to describe an approach to urban and regional extension utilizing both academic programming and field activities. Examples will be drawn from the greater Akron area and from northeast Ohio.

9:15 COOPERATIVE UNIVERSITY/INDUSTRIAL PROGRAM; A NEW DIRECTION IN BASIC RESEARCH  
P. Joseph Vertucci, Grants Administrator, Northeastern Ohio Universities College  
of Medicine, Rootstown, Ohio 44272

Basic research is under attack, as industry has directed its research effort to applied research. The burden of basic research has fallen increasingly on academia. This trend has serious implications. Basic research has been a recognized strength of technological advancement. The New York Times reported in July, 1980, that West Germany and Japan have now surpassed the United States in basic research efforts. The implications are of some importance. While the West German and Japanese economies are strong, notwithstanding worldwide inflation, the American economy is faltering.

At the same time that American industry is directing its research effort toward applied research, American colleges and universities cannot completely fill the need for basic research. Basic research monies, primarily federal sources, have not increased to sufficiently offset inflation. What is needed is an innovative approach which benefits American industry and utilizes the basic research capabilities of American colleges and universities.

Over the past several decades, the academic community has invested heavily in equipment, scientific personnel and the capacity for basic research, while American industry has moved toward high return on investment through applied research. These two major institutions of American society must develop a closer relationship in the future. This paper will examine the possible areas of collaboration between academia and industry with particular interest in the emergence of industrial sponsored basic research on the college and university campus.

DECLINING FEDERAL REVENUES AND URBAN SERVICE DELIVERY, PETER J. LEAHY &  
DEBORAH G. BICKFORD, DEPARTMENT OF URBAN STUDIES, UNIVERSITY OF AKRON

9:45

This paper examines the impact of changes in federal spending upon service delivery in 100 large cities. Using regression analysis techniques we investigate changes in service delivery resulting from changes in federal revenues. We are particularly interested in how this process operated for cities at different levels of fiscal strain. Policy implications are discussed.



IMPACT ASSESSMENT IN PLANNING FOR SCARCITY, James W. Cowden, Hiram College, Hiram Ohio, 44234.

10:00

The conditions of scarcity increasingly imposed by economic and environmental constraints, require the allocation of scarcer benefits and increasing disbenefits. These decisions will impose changes in life style and diminishing expectations that can result in social disruption. If conflict and violence related to the perceived inequity of allocations are to be avoided or minimized, decision-makers must be informed of the nature of the choices and their potential impacts. Impact and technology assessment have evolved as techniques to alert affluent nations to the unintended effects of development on the environment and therefore on the community, present and future. This paper defines the role of the impact assessment analyst in delineating the choices which will increasingly afflict this transition period and for which an information base must be generated. Equity concerns, the routine questioning of fairness or unfairness and to whom, and the identification of causal agents and responsibilities for mitigation are areas that should concern impact assessment. Social conflict potential and approaches to its assessment are discussed.

THE EFFECT OF SIZE ON PRODUCTIVITY OF AN ORGANIZATION. F.J. Jankowski. Wright State University, Department of Engineering, Dayton, Ohio 45435.

10:30

A large organization may benefit from economy of services, larger potential capital investment, relatively larger sales and marketing groups, and in other ways. A small organization may benefit from better motivation and interaction between employees, improved flow of ideas and of materials, less formality and "paperwork," and similar largely personnel related factors. Applying the measures of information processing capability of individuals give limits of 200 to 2000 as separating "small" from "large" organizations. Means of retaining the benefits of "small" in an organization faced with growth include: subdividing to have a number of small organizations; utilization of technological gatekeepers and bridge scientists; use of a matrix organizational structures.

10:45 BUSINESS MEETING

## **P. ADMINISTRATIVE SCIENCES & PLANNING**

FIRST AFTERNOON SESSION

229 KAUKA HALL

MIMI BECKER, PRESIDING

1:30 SYMPOSIUM: "PLANNING IN A PERIOD OF SCARCITY"

See front of program for a more complete description.

Moderator: Mimi Becker, Co-director, Environmental Studies Department, Hiram College, Hiram, Ohio

Speakers: PLANNING WITH LESS: NEGOTIATED INVESTMENT STRATEGIES  
James Kunde, Director, Urban Affairs Program, Kettering Foundation, Dayton, Ohio

QUALITY EDUCATION AND LIMITED RESOURCES: PLANNING AHEAD  
Richard Tormasi, Superintendent of Schools, Crestwood District, Mantua, Ohio

SOCIAL CONFLICT POTENTIAL IN AN ERA OF SCARCITY: IDENTIFICATION OF CAUSAL AGENTS AND RESPONSIBILITIES FOR MITIGATION  
James. W. Cowden, Co-director, Environmental Studies Department, Hiram College, Hiram, Ohio

RESOURCE SCARCITY, POVERTY, AND EQUITY ISSUES: DISTRIBUTION OF PERSONAL EQUITY: AN ECONOMIC PERSPECTIVE  
Steven Zabor, Department of Economics, Hiram College, Hiram, Ohio

# Q. ECONOMICS

FIRST MORNING SESSION

202 KAUKER HALL

CARLA EDLEFSON, PRESIDING

AN ECONOMETRIC MODEL OF PUBLIC SCHOOL FINANCING James Peterson and George Galster  
College of Wooster Wooster, Ohio 44691

8:30

The purpose of the work is the specification of a theory of per-pupil expenditures for public school districts and empirical tests of a model based on this theory.

The theory demonstrates how the determinants of school expenditures should vary depending on the financial status of the district. If district revenues exceed amounts needed to meet state-mandated minimum quality requirements, expenditures become a function of revenue only; if revenues fall short of such minimums, expenditures become a function of costs only. An econometric model based on this theory is specified, and its parameters are estimated using a national sample of school districts. Results serve not only as a test of the theoretical framework but also as policy guidance insofar as the most significant factors responsible for inter-district expenditure inequalities can be pinpointed.

SOLVING LARGE INPUT-OUTPUT SYSTEMS

Dr. Andrew Brody 505 King Avenue, Columbus, Ohio 43201

9:00

Input/Output analysis arrived at a stage where relatively large systems, with  $10^3$ - $10^4$  sectors, have to be solved as in the case of the U.N. World Model, or some conceivable interregional study of the U.S. economy.

This new order of magnitude makes the usual approach very cumbersome. Inversion, requiring about  $n^3$  operations, where  $n$  equals the number of sectors, is impossible with present day computers.

I propose a different way of attack, certainly not new, (already properly investigated by Varga in his "Matrix Iterative Analysis") to obtain solutions relatively cheaply. It is based on a universal condition of I/O matrices: they are non-negative, irreducible and well conditioned.

To solve  $(I-A)x = b$  for  $x$ , the following iteration may be suggested.

$$x_2 = Ax_1 + \rho_1 b$$

$$\text{where } \rho_1 = \frac{\sum_i (1-A)x_1}{\sum_i b}$$

and if  $x_n = x_{n+1}$  with the required precision

$$\text{then } x = x_{n+1} / \rho_n$$

ECONODYNAMICS. Herman J. Eichel, Ph.D., P.O. Box 16529, Cols., Oh. 43216.

9:30

Economic studies have in the past relied primarily upon mathematical tools developed in an effort to devise better models of the physical universe or were brought over intact as forms emerging from number theory research.

Econodynamics seeks to examine this aggregate phenomenae by application of the principles and logic originating in the field of thermodynamics. The innovative reasoning of Georgescu-Roegen established the logical foundation for this new science. This paper presents a discussion of historical examples including incidence of unstable equilibrium with resultant structure formation.

10:00

The effects of the economic policies enacted by the Roosevelt administration from 1933 to 1937 are visible still in the economy of the 1980's. By this measure alone, the New Deal stands as perhaps the most important economic event of this century. A point more debatable, however, is the question of the efficacy of the New Deal in ameliorating the woes brought on by the Great Depression. As a means of shedding some light on this issue, a multi-equation macroeconomic model of the American economy was constructed, using traditional macroeconomic theory as a foundation. This equation system serves as an analytical tool for evaluating the effectiveness of fiscal and monetary policy during the time period in question. More specifically, the paper consists of five sections: an explanation of the econometric theory requisite to understanding the mathematical construction of the model, a summary of the macroeconomic theory upon which the model is based, a complete specification of the model (including theoretical and empirical justification for departures taken from standard macro-theory), the results of the regression analysis, and a concluding statement which evaluates the effectiveness of the programs in the context of statistical and intuitive inference. Through such a study, the author hopes to offer some insight into the unresolved question of the success of the first-term Roosevelt administration in dealing with difficult problems such as persistent unemployment, the sluggish rebound of the durable goods market, and the extreme contraction of the money supply.

ECONOMIC GROWTH AND HIGHWAYS: A CASE OF OHIO by Rajindar K. Koshal and Robert L. Williams, Ohio University, Athens, Ohio 45701.

10:30

The purpose of this study is to estimate a statistical relationship between economic development and highway quality in a given region. A comparison of the estimates for lagging regions with the corresponding estimates for the leading regions establishes the importance of highways to such regions. The statistical analysis suggests that there is a positive relationship between the level of highway capacity and the level of income in a region. In terms of an increase in the level of income it is observed that, in general, less prosperous areas are more responsive to increments in highway quality than are prosperous areas. This degree of responsiveness cannot be fully attributable to the level of highway capacity in a particular region because growth of the region is also affected by a better highway network in the neighboring areas and throughout the state. To some extent, the improvement in the highway network in Ohio contributed to narrowing the disparities in per capita incomes in the various regions. It was observed that the interstate highway network not only induced growth in a particular region, but also contributed to the growth of the neighboring regions.

## Q. ECONOMICS

FIRST AFTERNOON SESSION

202 KAUKA HALL

CARLA EDLEFSON, PRESIDING

1:30 BUSINESS MEETING

"IS THERE A GRESHAM'S LAW OF GRADUATE EDUCATION?"

Robert H. Wessel, University of Cincinnati, Dept. of Economics,  
Cincinnati, Ohio 45221

1:45

In the late 60's and early 70's the number of graduate programs especially at the Ph.D. level increased substantially. Many of these new programs are found at newer or rapidly expanding state institutions. The concern has frequently been expressed that the large volume of output of these programs will necessarily cause a deterioration in quality. Furthermore since many of these new offerings are well financed the possibility exists that much of this expansion will take place at the expense of established quality programs.

This paper analyzes data taken from the state of Ohio. Its conclusions are that graduate or doctorate education has indeed expanded substantially but that quality offerings are not necessarily in jeopardy.

2:15

## SYMPOSIUM: "PROMOTING OHIO RESEARCH AND DEVELOPMENT"

See front of program for more information.

Arranged by Patricia A. Fening, Ohio Development Financing Commission.

DISCUSSION OF THE FINDINGS OF A 1979-80 STUDY OF RESEARCH AND DEVELOPMENT IN OHIO. By Mr. J. Thomas Walker; Ohio Development Financing Commission, P.O. Box 1001, Columbus, Ohio, 43216.

2:15

During the past year, the "reindustrialization of America" has become a phrase which describes, hopefully, a new and important direction of national policy. An important part of any effort to rebuild our industrial base will involve rethinking and then changing some of the basic processes involved in our major industries. This means that a large amount of research and development funds must be expended to discover new ways this country can utilize our resources--both human and mineral--in a more productive, efficient, and environmentally sound manner. Our nation's future security will largely depend on maintaining a strong, modern and competitive industrial base. The core of America's industrial manufacturing lies in the Great Lake states.

In order to assist a better understanding of Ohio's problems and opportunities in this role, the Ohio Development Financing Commission during 1979 and 1980 undertook a study of the past and current trends and the future possibilities of industrial research and development activity in Ohio. Our study, contained in six reports, covered a broad range of participants in Ohio business research and academic communities. Based on their input, we have assembled a strategy for adoption by our state's government. That strategy is aimed at accelerating R&D activity in Ohio, to benefit the citizens of Ohio--by producing new direct employment and by increasing the probability that new future-oriented business startups will take place and prosper in our region.

RESEARCH AND DEVELOPMENT OPPORTUNITIES IN OHIO. By Alvin M. White; Battelle Columbus Division, 505 King Avenue, Columbus, Ohio 43201.

2:45

The objective of this study was two fold; first, to identify specific and generic large-scale industrial research and development needs of industries in the U.S., and second, to determine for which of those identified needs, not currently receiving large-scale government funding of R&D, Ohio can be seen as a logical location for conduct of the R&D. In this study the attributes of the State of Ohio and nearby surrounding regions were identified, as were the large-scale research and development needs of U.S. industry. A cross comparison of these R&D needs and Ohio's attributes was conducted. Six R&D needs were identified as most attractive for the establishment of R&D activities in Ohio. These six include:

- coal-based process for direct reduction of iron;
- technology to utilize high sulfur coal as an acceptable energy source;
- improved coal gasification and liquefaction technology and processes;
- less energy intensive glass making technology;
- in-stream and low-head hydroelectric generation technology; and
- shallow oil well recovery systems and technology

WORLDWIDE REINDUSTRIALIZATION THROUGH COMPUTER INTEGRATED MANUFACTURING By Dr. M. Eugene Merchant; Cincinnati Milacron, Inc., 4701 Marburg Avenue, Cincinnati, Ohio 45209.

3:15

Industrialized nations throughout the world are experiencing today a keen and provocative challenge and opportunity to reindustrialize. This challenge and opportunity derives in large part from the tremendous potential for improvement of the economic and social well-being of nations offered by the relatively new technology of computer integrated manufacturing. Manufacturing today is responsible for about two-thirds of the real wealth created annually in most industrialized nations. Thus improvement of productivity in manufacturing has tremendous leverage to increase employment and raise the standard of living and quality of life in a nation.

Computer integrated manufacturing, though still in its infancy, has already demonstrated tremendous and unique potential to increase productivity in manufacturing, through on-line optimization and automation of the total system of manufacturing. Therefore, most of the industrialized nations of the world have formulated and are pursuing goals, strategies and programs for research, development and implementation of computer integrated manufacturing. The United States has in general been relatively less effective than some other nations, thus far, in pursuing research, development and implementation of this technology, even though the basis for it was developed here. Examples of the programs being pursued by various countries will be cited.

# R. ECOLOGY

FIRST MORNING SESSION

200 KAUKU HALL

ROBERT E. CARLSON, PRESIDING

SURVEY OF THE FISH OF THE CUYAHOGA RIVER TRIBUTARIES IN THE CUYAHOGA VALLEY NATIONAL RECREATION AREA. Lowell P. Orr, Steven R. Kleeberger, and Robert D. Davic. Dept. of Biological Sciences, Kent State University, Kent, OH 44242.

8:15

Twenty-eight fish species were collected in 14 tributaries within the Recreation Area in the spring, summer, and fall of 1979. Streams sampled included Furnace Run, Salt Run, Haskell Run, Boston Run, Dickerson Run, Langes Run, Yellow Creek, Robinson Run, Brandywine Creek, Columbia Run, Spring Run, Stanford Run, Chippewa Creek, and Tinker's Creek. The streams appeared to have reasonably high water quality except for Brandywine Creek and Tinker's Creek. Based on the number and kind of species now in Brandywine Creek and Tinker's Creek as compared to the species reported by Trautman from these streams in his 1925-1950 studies, both streams appear to have deteriorated considerably. Our ranking of the five largest tributaries from the highest water quality to the lowest based on number and kind of fish species present is (1) Furnace Run, (2) Yellow Creek, (3) Chippewa Creek, (4) Tinker's Creek, and (5) Brandywine Creek. Species collected in the 14 tributaries were Dorosoma cepedianum, Camptostoma anomalum, Clinostomus elongatus, Ericymba buccata, Nocomis micropogon, Notemigonus crysoleucas, Notropis cornutus, Notropis stramineus, Phoxinus erythrogaster, Pimephales notatus, Pimephales promelas promelas, Rhinichthys atratulus meleagris, Semotilus atromaculatus, Catostomus commersoni, Hypentelium nigricans, Ictalurus natalis, Ictalurus nebulosus, Culaea inconstans, Lepomis cyanellus, Lepomis gibbosus, Lepomis gulosus, Lepomis macrochirus, Lepomis microlophus, Micropterus salmoides, Pomoxis nigromaculatus, Etheostoma caeruleum, Etheostoma flabellare flabellare, and Etheostoma nigrum.

WATER QUALITY AND PERIPHYTON GROWTH IN STREAMS WITHIN THE CUYAHOGA VALLEY NATIONAL RECREATION AREA. Robert E. Carlson. Dept. of Biological Sciences. Kent State University, Kent, OH 44242.

8:30

During the summer of 1978 I collected water samples from 12 stations on the Cuyahoga River and its tributaries within the boundaries of the CVNRA. Periphyton was grown on artificial substrates in 3 of the streams and analyzed for chlorophyll accumulation. Several indices were used to rank the water quality. The best water quality was found in Furnace Run and Yellow Creek, the worst in Brandywine Creek and Tinkers Creek. Periphyton biomass and accumulation rates showed no clear relationship to water quality, but growth appeared to be inhibited in Tinkers Creek.

ANAEROBIC RELEASE OF AVAILABLE PHOSPHORUS FROM CUYAHOGA RIVER SEDIMENTS. Kurt W. Whitford, Robert T. Heath, and Theo Verstrael Department of Biology Kent State University, Kent, Ohio 44240

8:45

Understanding the potential relative contributions of various land-segments to the eutrophication of Lake Erie is necessary for a coherent watershed planning policy. Because available phosphorus is most often the limiting nutrient in Lake Erie, and because most phosphorus enters the lake in particulate form, we have investigated the availability of particulate phosphorus inputs to the Cuyahoga River (northeastern Ohio). In particular we have examined the potential of river sediments collected at various stations along the Cuyahoga River for releasing available phosphorus under anaerobic conditions (conditions generally regarded as leading to a significant release of adsorbed phosphorus). Surface sediments were collected from the stream bed. The samples were centrifuged, resuspended in autoclaved, phosphorus-free water in BOD bottles, and incubated at 20°C in the dark. Release of inorganic phosphorus from the sediments was measured as microbial activity reduced oxygen tension (followed polarimetrically). Results showed an increasing trend in anaerobically releasable inorganic phosphorus from the river's headwaters to Lake Erie. Urbanized areas and marshes contributed the most anaerobically releasable phosphorus as phosphate.

9:00 FISH SURVEY IN THE UPPER PORTAGE RIVER, OHIO, 1973-1975. Robert A. Laskowski-Hoke, Aqua Tech Environmental Consultants, Inc., Melmore, Ohio 44845; M. James Norrocky, Department Biological Sciences, Bowling Green State University, Bowling Green, Ohio 43403; Bayliss L. Prater, Aqua Tech Environmental Consultants, Inc., Melmore, Ohio 44845.

The objective of this survey was to make a qualitative analysis of fish populations and species distribution from the dam near the town of Elmore, Ohio up into the headwaters of the Portage River. The survey was conducted during the years 1973-1975 to determine the presence of particular species and their relative abundances.

Twenty-three sampling sites were selected to represent various habitats on the south, north, and east branches of the Portage River as well as several small tributaries. Each site was sampled from one to six times during the survey using seines of various lengths and mesh sizes. Electro-fishing techniques were also utilized. All fishes were preserved in 9% formalin. After identification and enumeration, samples were deposited at the Ohio State University Zoology Museum, Fisheries Section.

During the survey, 6715 individuals representing 46 species and eight families were collected. The families Cyprinidae and Lepisosteidae illustrated the highest and lowest relative abundances, respectively; with Notropis umbratilis cyanocephalus and Lepisosteus osseus illustrating the species with the highest and lowest relative abundances, respectively.

#### PRELIMINARY INVESTIGATIONS OF LONGITUDINAL DISTRIBUTION AND FISH SPECIES DIVERSITY

9:15 IN ROCK RUN, CLARK COUNTY, OHIO. Rob Reash, 101 E. Cassilly St., Springfield, Oh. 45504  
Jane Bush, 602 N. Wittenberg Ave., Springfield, Ohio. 45501

Preliminary studies were initiated on Rock Run, a small tributary to the Mad River, beginning 23 September 1980. Fish species diversity and distribution were studied longitudinally and between riffle and pool habitats. Species addition was observed longitudinally, while differing species composition between and within riffle and pool habitats was strongly indicated. Equitability of species, both longitudinally and within the riffle/pool habitats, remained significantly unbalanced. Physical features of substrate composition and current velocity were shown to limit species abundance and diversity.

9:30 FACTORS INFLUENCING PHYSICAL AND CHEMICAL PARAMETERS OF THE ROCK RUN-MILLER CREEK WATERSHED, CLARK COUNTY, OHIO. James B. Cotner Jr. and Mark S. Kieser, Department of Biology, Wittenberg University, Springfield, Ohio 45501.

A preliminary study of the physical and chemical parameters of the Rock Run-Miller Creek watershed was undertaken in September of 1980. The watershed, located in Clark County, drains an area of 16.6 km<sup>2</sup>. The primary stream, Rock Run, is approximately 9.0 km long. Underlying the drainage in the headwaters are silty clay loams (0 - 2 % slope) beneath which is calcareous glacial till. The lower reaches of the stream cut a deep gorge through overlying Cedarville and Springfield Dolomite formations. The headwaters are predominantly agricultural with little overhanging vegetation. The gorge area is developed residentially and has extensive overhanging vegetation. Nitrate values were high (generally 0.15 ppm and above) along with orthophosphate levels which several times reached values above 0.15 ppm. The greatest sources of nutrient pollution were determined to be leachate from septic sewage and agricultural runoff.

SUMMER ABUNDANCE AND PERIODICITY OF LARVAL FISHES IN BEAVER CREEK, OHIO:  
ASSESSMENT BY TWO COLLECTING METHODS. Roger E. Thibault and Orville S. Burch.  
Department of Biological Sciences, Bowling Green State University, Bowling  
Green, OH 43403.

9:45

From June through August, 1980, larval fishes were collected by two sampling methods in a tributary of the Maumee River, Ohio, characterized by dramatic variations in water levels. Stationary nets were set for 2 h intervals on 11 days; a shoreline sampler, designed by one of us (OSB), was employed on 15 days at 6 h intervals. Diversity, abundance and larval stage of fishes collected by the two methods differed dramatically. Stationary nets yielded mostly prolarvae (.88) whereas about half (.56) of the fishes collected by the shoreline sampler were prolarvae. The shoreline sampling resulted in sample sizes ( $\bar{x}$  = 35.3) in excess of 10 times those found in drift nets ( $\bar{x}$  = 3.1). Additionally, shoreline sampling exposed a higher diversity of taxa ( $N$  = 14) than stationary sampling ( $N$  = 6). Both methods, however, identified diverse populations of cyprinids, catostomids, centrarchids and percids that apparently spawn in Beaver Creek throughout the summer. Relative abundances of larvae caught by the two methods were not correlated ( $r$  = -.3, ns). These data suggest the limited use of drift nets in stream sampling and reinforce the need for alternative sampling methods for taxonomic and ecological studies. Shoreline sampling at 0600, 1200, 1800 and 2400 h revealed a distinct pattern of larval periodicity. Maximum abundance were collected at 2400 h, a consistent phenomena in the 120 samples ( $t$ -test,  $p$  < .001).

THE FEEDING ECOLOGY OF LARVAL FISHES IN A FRESHWATER STREAM. Orville S. Burch and Roger E. Thibault. Department of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403.

10:00

Larval fish were collected from a tributary of the Maumee River, Ohio, with a specialized collecting device. As an index of potential food availability, drift samples of plankton, zooplankton and nekton accompanied fish sampling. A total of 120 fish and 40 drift samples were collected on 10 days at 0600, 1200, 1800, 2400 hours. Gut contents of fish, categorized by life stages, were analyzed quantitatively by light microscopy. Drift sample compositions were determined with Palmer cells. Results indicate that all taxa of larvae are highly selective with respect to at least one group of prey. In some taxa, prey selection is correlated with the abundance of the prey in the drift. Other taxa appear to be cropping benthic organisms. Selectivity of food items is not correlated with physical gape of the mouth. A total of 17 different taxa were analyzed for gut contents, feeding selection and feeding periodicity.

BOTANICAL AND GEOLOGICAL STUDIES AT SHELTON'S MARSH STATE NATURE PRESERVE BARRIER BEACH, ERIE COUNTY, OHIO. Cheryl A. Royal, 904 Salem Drive, Huron, OH 44839

10:15

The topography and vegetation of the barrier beach at Sheldon's Marsh State Nature Preserve were mapped during the summer of 1980. A textural analysis of the beach sand was made, and results were used in statistical analyses of vegetation-sediment relationships. No correlation was found between the presence of vegetation and the size of sand grains. These data were used to study the natural controls and effects of the wave washover process on the barrier beach. The absence of vegetation promotes washover, and stands of plants re-route the water as it moves over the beach. The topography of the beach influences the occurrence of washover as well as the distribution of vegetation. Low, flat areas are subject to washover, and plant communities are therefore unable to become established. Washover and wave action sort and distribute the beach sand according to grain size and mineralogy, separating the larger quartz grains from the smaller garnet and magnetite grains. As a result of continuous washover, the barrier beach is slowly curving and migrating southward, posing a threat to the survival of the 300-acre marsh to the south of the barrier.

10:30 BUSINESS MEETING

## R. ECOLOGY

SECOND MORNING SESSION

201 KAUKU HALL

ROBERT T. HEATH, PRESIDING

RESOURCE PARTITIONING IN SOME NET SPINNING CADDISFLY LARVAE (TRICHOPTERA: HYDROPSYCHIDAE). Martin A. Hilovsky, Department of Biological Sciences, Kent State University, Kent, OH 44242.

8:15

At least four species of the genus Hydropsyche were found to coexist as larvae in a small woodland stream in northeastern Ohio. The larvae of all species construct retreats and capture nets on and underneath rocks in areas of relatively swift-flowing water.

Larvae and retreats were collected from rocks at 132 sampling points within a riffle. Data on stream depth and current velocity, and exact location of nets on the rock substrate were obtained. Larvae were identified and their associated capture nets mounted and measured to determine mean mesh size.

The mesh of the capture nets varied in size and shape among the species. There was an increase in mean net mesh size in successive larval instars. The spatial distribution and net mesh size for each species was related to current velocity. Other workers have shown that net mesh size may reflect particle size selection, and thus provide a means by which resources are partitioned. Data gathered in this study tend to support this contention, but several alternate hypotheses are presented which may explain observed patterns of larval distribution and net mesh size.

HABITAT SELECTION BY SANDY-BOTTOM STREAM CHIRONOMIDAE (DIPTERA: INSECTA)

John G. Rae, Department of Zoology and Microbiology, Ohio University, Athens, Ohio 45701

8:30

A set of five plastic boxes, each filled with sediment of a different grain size (4mm; 2mm; 1mm; 500µm; 250µm), was placed in a run in Clear Creek, a fourth order stream in south-eastern Ohio. Replicate cores of 10 cm<sup>2</sup> area, sectioned in one cm intervals to a depth of 8 cm, were taken one week after placement of the boxes in the stream. This experiment was run in June and again in October, 1980. Colonization resulted by means of drift and selection of sediment type by midge (Chironomidae) larvae was analysed by analysis of variance. ANOVA indicated significant differences in Chironomid distributions with depth in sediment for both dates and between sediment sizes for October. Distributions were not significantly different between boxes in June probably because of low faunal densities. Identification to species illuminated finer differences in faunal distributions within the five sediments and eight depths tested. For example, in June, Cricotopus sp A preferred gravel sized sediments while Saetheria tylus preferred coarse sands.

DISTRIBUTION OF CHIRONOMIDAE (DIPTERA) LARVAE IN GRAVEL PIT PONDS ALONG THE LITTLE MIAMI RIVER, SOUTHWESTERN OHIO. William H. Hopple, Dept. of Biological Sciences, University of Cincinnati, 45221

8:45

Forty-four ponds in 26 gravel pits located along a 30 mile stretch of the Little Miami River were surveyed in 1980. Chironomidae larvae, which comprised greater than 50% of the macroinvertebrates in each pond, were sampled with Hester-Dendy artificial substrates three times during the year: March-April, July-August and October-November. At the same time, physical, chemical and other biological characteristics were determined. These were: age, surface area, shoreline development, depth, sediment composition, temperature, light penetration, pH, alkalinity, conductivity, water color, nutrient concentrations, oxygen, C productivity and algal biomass. Despite the fact that the ponds have a common water supply and similar bottom composition at origin, ponds of similar age were extremely diverse in many of the parameters measured. Ranges and means for several characteristics from the summer sampling were: pH 7.8-10.0,  $\bar{X}=8.46\pm0.39$ ; alkalinity 52.6-270.8 ppm CaCO<sub>3</sub>,  $\bar{X}=137.6\pm43.4$ ; conductivity 171-720 µmhos/cm,  $\bar{X}=372.1\pm103.3$ ; reactive phosphorus 0.0-372.1 µgm PO<sub>4</sub>/l,  $\bar{X}=13.6\pm47.8$ ; C productivity 16.6-3070 mgC/m<sup>2</sup>/hr,  $\bar{X}=347.0\pm572.0$ . The Chironomidae larvae species composition of each pond was analyzed by multiple regression-partial correlation with the physical, chemical and biological characteristics. Total species numbers were compared between multiple pond gravel pits and pits with single lakes of equal total surface area. Supported by a research initiation grant from the Mining and Mineral Resources Research Institute.



9:00

Aquatic oligochaeta were quantitatively sampled from 10 stations on the Sandusky River between 26 October 1973 and 21 September 1974. Grab water samples were collected and analyzed for 15 parameters at the same stations. Eighteen species were collected with *Branchiura sowerbyi*, *Limnodrilus cervix*, *L. hoffmeisteri*, *L. spiralis*, *L. udekemianus* and *Tubifex tubifex* comprising 97.8% of the total identified fauna. Species composition and seasonal abundance differed in 3 distinct regions of the river, and the most oligochaetes/m<sup>2</sup> were collected in July and the least in May. Three sewage treatment plants seemed to have an impact on the number of species and mean number of individuals collected below their outfalls. Species diversity was determined at all stations and was significantly correlated ( $P < .05$ ) with 13 of the 15 physico-chemical parameters.

SIGNAL ANALYSIS OF ECOLOGICAL SYSTEMS. Robert F. Gaugush Department of Biological Sciences, Kent State University, Kent OH 44242.

9:15

The analysis of input/output signals to and from living systems has been largely ignored in the development of ecological theory. The way in which a system transforms an input signal into an output signal produces information about the behavior of the system which is independent of the need for complete knowledge of the system's complex structure. Specific test input signals are used to generate the fundamental dynamics of the system. These inputs, the unit impulse and the unit step, are transformed by the system into the unit impulse response and the unit step response respectively. The responses serve to completely characterize the behavior of the system in both the time and frequency domains. Knowledge of the system's behavior in the time domain provides a predictive tool in that the system's response to any input can be generated from this information. Behavior in the frequency domain predicts the response of the system to periodic inputs. The time and frequency domain characterizations also provide a means for studying system stability. Both experimental and natural systems can be studied with signal analysis. Signal analysis can lead to a non-mechanistic description of complex system behavior which may be necessary for the further development of an ecological systems theory.

PLANKTON PHOSPHATASES IN THE DYNAMICS OF PHOSPHORUS. M. J. Boavida and R. T. Heath. Department of Biological Sciences, Kent State University, Kent, Ohio 44242.

9:30

The purpose of this study was to determine whether the soluble phosphatases released by Cladoceran zooplankton originate from the zooplankton themselves or from their prey. Unialgal cultures of *Chlamydomonas acidophila* and cultures of *Daphnia magna* fed upon *Chlamydomonas* were utilized as study systems. Both acid and alkaline phosphatases were found to be related to each group. Enzyme activity is much higher at acid pH (pH 5.0) for *Chlamydomonas*, and *Daphnia* phosphatase is predominantly an alkaline phosphatase (pH 9.0). Enzymes of both groups of organisms are affected similarly by ionic strength and have similar affinities for the substrates investigated. However, differences exist regarding their temperature dependence, Michaelis-Menten Kinetics, and inhibition of phosphatase activity by orthophosphate. These results indicate that zooplankton may be producing their own phosphatases, thus participating directly in the recycling mechanisms that regenerate phosphorus into a form available for their autotrophic prey.

9:45

An island marsh in the James River, created out of sand dredged from a nearby navigation channel, was compared with a neighboring natural marsh as part of the U.S. Army Corps of Engineers Dredge Material Research Project. Approximately two years following creation and seeding of the island with aquatic vegetation, meiobenthic community structure and composition was determined using a random-stratified sampling scheme. Stratification was based on vegetation type and extent of tidal inundation. Eight replicate cores, 2.5 cm diameter and 10 cm deep, were taken randomly from each stratum, fixed with a 10% buffered formalin solution containing Phloxine B stain, and animals retained on a 125 µm screen were counted and identified to species level.

In spite of differences in sediment types between the two marshes (the island was mostly sand and the natural marsh mostly silt-clay) the permanent meiobenthic species composition was remarkably similar. Nematodes were the dominant taxon, both numerically and in terms of species richness. Hierarchical data analysis (clustering) of samples from each marsh showed extent of tidal inundation was the physical parameter most responsible for differences found between strata of these tidal freshwater meiobenthic marsh communities, regardless of sediment type.

COMMUNITY STRUCTURE, DRIFT, AND UPSTREAM MIGRATION OF THE CRUSTACEANS SYNURELLA DENTATA HUBRICHT AND LIRCEUS FONTINALIS RAF. IN A TEMPERATE SPRING. James B.

10:00 Cotner Jr., Department of Biology, Wittenberg University, Springfield, Ohio 45501 and Mark J. Butler, Department of Zoology, Ohio State University, Columbus, Ohio 43210.

OZ Spring is a small temperate spring issuing from a dolomite (Cedarville Dolomite--Silurian Age) bluff and flowing down a steep gradient about 100m north into the Little Miami River. Monthly physical and chemical data indicate that conditions in the spring are relatively constant. Air temperatures varied considerably ( $-4^{\circ}$  to  $35^{\circ}$  C) whereas water temperatures varied only  $3^{\circ}$  C. Nitrate values were generally high but showed considerable variation (0.8 - 5.0ppm) while orthophosphate levels remained below 0.1ppm. Nasturtium officinale Gluck, an important energy source, covered the upper reaches of the spring throughout the sample period.

Species equitability values are low due to large numbers of the isopod, Lirceus fontinalis Raf., and the amphipod, Synurella dentata Hubricht. Monthly 24-hour sampling shows peaks in both drift and upstream migration of both the asellids and gammarids one hour after sunrise and one hour before sunset. Peaks were negatively correlated with light intensities. Butler (1980) and Butler and Hobbs (1980) support these findings in their study.

AQUATIC INSECTS OF A WOODLAND SPRING. Randy Hunt. Department of Biological Sciences, Kent State University, Kent, Ohio 44242.

10:15

Although one of the more common aquatic habitats, there have been very few taxonomic surveys and ecological studies of North American cold water springs.

Aquatic insect emergence data were obtained over a seven month period (April-October, 1979) from a woodland spring in northeastern Ohio. Insects were collected using pyramid emergence traps ( $1\text{ m}^2$ ) placed at 10 m intervals (five stations). Results indicate distinct spatial and temporal segregation of the component aquatic species. Also, several species of taxonomic interest were collected. Lepidostoma vernalis and Polycentropus carolinensis (Trichoptera) are new state records for Ohio. Further, an undescribed species of the genus Leuctra (Plecoptera) was collected. The geographical distributions of several possible relic species are discussed.

10:30 BUSINESS MEETING 200 KAUKU HALL

## R. ECOLOGY

FIRST AFTERNOON SESSION

200 KAUKU HALL

G. DENNIS COOKE, PRESIDING

THE STATISTICAL EVALUATION OF DATA FROM A 96 HOUR SEDIMENT BIOASSAY OF DUNKIRK HARBOR, NEW YORK RELEVANT TO DISPOSAL OPTIONS. Robert A. Laskowski-Hoke, Aqua Tech Environmental Consultants, Inc., P.O. Box 76, Melmore, Ohio. 44845.

1:30

At the request of the U.S. Army Corps of Engineers, a 96-hour sediment bioassay test using Hexagenia limbata, Daphnia magna, and Pimephales promelas was conducted between 5 June and 9 June 1980 on sediment samples from Dunkirk Harbor, New York (Lake Ontario). The purpose of the test was the evaluation of the sediments from the harbor with summary recommendation of disposal procedures.

The raw mortality data were statistically analyzed using Cochran's test for the homogeneity of variances to determine if an ANOVA could be performed. The raw data were found to have heteroscedastic variances and the transformations  $\ln(x + 1)$  and  $\arcsin \sqrt{x}$  employed in an attempt to achieve homogeneity of variances. This procedure was unsuccessful and an approximate test of the equality of the means was used in data analysis as an alternative to ANOVA.

The results of the test for the approximate equality of the means and the use of the SNK multiple range test illustrated significantly lower survival of the test organisms in the inner harbor, reference site, and disposal site sediments when compared to the control sediments ( $\alpha = 0.05$ ). However, no statistically significant difference was found between the disposal site and the inner harbor, outer harbor, or reference site sediments. As a result of the statistical analysis of the bioassay data, it was recommended that dredged material from Dunkirk Harbor, New York be disposed of in the open lake (Lake Ontario).

ORGANISMS AS INDICATORS OF PRESENT AND FUTURE HABITATS. Barney W. Cornaby, Kenneth M. Duke, and Steven E. Pomeroy. Bio-Environmental Sciences Section, Battelle's Columbus Laboratories, 505 King Avenue, Columbus, Ohio 43201.

1:45

We use arthropods, birds, mammals, plants, and other groups as (a) indicators of present habitat patterns and (b) tools for predicting future habitat composition. An indicator is a measure that reveals important aspects of the structure and function for some portion of the habitat without exhaustive study of that part, and as such is a cost-effective approach to problem-solving. Such indices as the following have been applied: presence or absence, number of species per unit, number of individuals per unit, species diversity, biomass per unit, and predator-prey ratios. The research has been conducted in Gulf of Mexico marshlands, New Mexican deserts, Venezuelan coastal ecosystems, and West Virginian forests. Situations ranged from pipelining to watershed management to consequences of coal gasification and oil-burning power facilities. The techniques are constantly being refined to meet ever changing environmental management requirements.

THE USE OF CHLAMYDOMONAS ACIDOPHILA AS A BIOASSAY ORGANISM IN NUTRIENT LIMITATION EXPERIMENTS IN ACID LAKES. Elizabeth L. Buchanan and Robert E. Carlson. Department of Biological Sciences, Kent State University, Kent, OH 44242.

2:00

A strain of Chlamydomonas acidophila isolated from an acid mine lake will grow in media from pH 3 to pH 9. As a bioassay organism for acid conditions, Chlamydomonas acidophila is potentially superior to Selenastrum capricornutum which grows well only above pH 5.0. Nitrogen and phosphorus starved cells were used in a limiting nutrient bioassay on acid strip mine lake water (pH 3.45). The cultures were set up in a latin square design using enriched lake water with N to P ratios ranging from .3 to 300. Growth curves and maximum standing crops were measured to compare responses to the various N to P ratios. The results of this and other experiments indicate that the steady state biomass of this lake was largely nitrogen limited but that the rate of diffusion of  $\text{CO}_2$  across the air-water interface modified growth rate.

MEIOBENTHIC BIOMONITORING OF THE LAKE HOPE MINE DRAINAGE ABATEMENT PROJECT: PRELIMINARY RESULTS. William D. Hummon, Dept. Zool. & Microbiol., Ohio Univ., Athens 45701.

2:15

Most recent in the attempts to reclaim Lake Hope (Vinton Co., Ohio) as a multiple-use recreation site has been the Lake Hope Mine Drainage Abatement Project. The project was sponsored by Ohio DNR and U.S. EPA and was completed in December, 1979. It was an energetic attempt to seal off acid effluent from numerous drift mines in Big Four Hollow by means of a trench dug to bedrock and filled with a clay-blanket dam. Individual mines were also sealed by double bulkhead or surface sealing techniques. A 40% reduction in overall acid runoff into Lake Hope was anticipated. U.S. Geological Survey is monitoring stream flow and chemistry at 2 gauging stations. We are monitoring long-term aquatic recovery of micrometazoa at 4 sites, 2 during Su-Fall on Big Four Creek (BF) and 2 year-round on Sandy Run (SN), leading from BF to Lake Hope. Rate of recovery will be determined by comparison with 2 unpolluted year-round control sites on Strouds Run (ST, Athens, Co.) and numerous other Fall-sampled stream sites. Two year's data (1976-77, 1979-80) are now available from SN and ST sites. Data from June and October 1980 at 6 sites from all 3 streams, using 3 way ANOVA and SNK a posteriori testing, show that  $\bar{A}x$  no. of taxa collected at  $ST > SN = BF$  and that  $Gx$  abundance of individuals collected at  $ST > BF = SN$ . Results, supported by both stream and sediment water chemistry, indicate that, as might be expected, no clear signs of recovery are evident during the first year following completion of the project. Year-round data indicate that fauna of all streams are subject to density-independent physical control in the form of erosional scour following rainfall, and that weather may be nearly as important as seasons or mine effluent in determining no. of taxa or abundances found.

THE DEVELOPMENT OF AN INTEGRATED SURFACE WATER QUALITY MONITORING STRATEGY IN OHIO. Daniel R. Dudley. Ohio Environmental Protection Agency, Division of Surveillance, 361 E. Broad Street, Columbus, Ohio. 43216.

2:30

Environmental monitoring is an important step in the management and protection of natural resources. Ideally, monitoring is the activity that "drives" the progression of events from problem identification and assessment, through management decisions on such issues as pollution abatement programs, and finally to the enforcement of environmental regulations. In Ohio the maintenance of this sequence of events is the primary function of the Ohio Environmental Protection Agency. The Office of Wastewater Pollution Control of the Ohio EPA has recently developed a 5-year water quality monitoring strategy in the hope of more closely reflecting the "ideal" model. The strategy sets forth nine basic objectives under the three ideal functions of problem assessment, management, and enforcement. A monitoring system matrix was used to define and evaluate the performance of 15 monitoring activities in meeting the objectives. A conceptual framework was used to evaluate, integrate, and modify the monitoring activities to best meet specific data needs. One, three, and five year goals were established for the monitoring program and the system is being used to plan ongoing activities. With further refinement we suggest that a similar approach would be effective in integrating all surface water monitoring activities in Ohio.

DISTRIBUTION OF PISOLITHUS TINCTORIUS ON DISTURBED AREAS. Richard J. Medve and Shan M. Gill. Biology Department, Slippery Rock State College, Slippery Rock, PA 16057.

2:45

Twenty-five reclaimed sites that had been surface mined for limestone, sand and gravel, or bituminous coal were used as study areas. The 12 sites with Pisolithus tinctorius basidiocarps had been mined for bituminous coal, planted with trees, and had large areas devoid of ground cover. P. tinctorius was associated with seven conifer and two woody angiosperm species. Pinus strobus had the highest percentage of trees associated with P. tinctorius and also the greatest number of basidiocarps per tree. The majority of the basidiocarps (98%) were found to the outside of the dripline. Each tree associated with P. tinctorius averaged 2.6 basidiocarps which were located at an average distance of 52.9 cm from the dripline, and in an area with 12% ground cover.

GENETIC VARIATION AND MORPHOLOGICAL RESPONSES TO A STRESS ENVIRONMENT IN  
POPULATIONS OF RUMEX ACETOSELLA L. (POLYGONACEAE). Michael A. Farris,  
Department of Botany, Ohio State University, Columbus, Ohio 43210

3:00

Different hypotheses predict either an increase or decrease in the amount of genetic variation within organisms living in a stress environment. To examine these hypotheses, populations of Rumex acetosella L. (six from old fields and six from strip mine wastes) were assessed for genetic and morphological variation. Starch gel electrophoresis shows 36% of the loci to be polymorphic. Preliminary data indicate genetic variation both within and between populations. Although much variation in leaf morphology was found in the field, six populations grown under uniform conditions for six months showed no significant differences in longest leaf length, longest leaf width, or number of leaves per rosette ( $p < .05$ ). Morphological plasticity and extensive vegetative reproduction appear to be responsible for the persistence of R. acetosella in such diverse habitats.

THE AQUATIC OLIGOCHAETA OF LAKE ERIE NEARSHORE STUDY (LENS): CENTRAL BASIN. Paul J. Crerar and Bayliss L. Prater, Aqua Tech Environmental Consultants, Inc., Melmore, Ohio 44845, and K.A. Krieger, Water Quality Laboratory, Heidelberg College, Tiffin, Ohio 44883.

3:15

Benthic macroinvertebrates were sampled at 63 stations in the Central Basin of Lake Erie between Vermilion and Ashtabula, Ohio, during June 1978 (55 stations) and September 1978 (8 stations). The oligochaetes were identified and enumerated to the lowest possible taxon.

Tubificidae and Naididae were the only families of Oligochaeta encountered, with Naididae at only 6% of the stations. Oligochaetes comprised 86% of all individuals and 40% of the benthic macroinvertebrate taxa. Sixty-seven percent of the oligochaetes sampled were immature. Limnodrilus hoffmeisteri was the predominant adult species, represented in 78% of the samples. The greatest densities ( $37,821/m^2$  maximum,  $5,123/m^2$  average density) occurred at major river mouth and harbor stations. Branchiura sowerbyi, previously reported only in the Western Basin, was observed at five stations between Vermilion and Lorain, Ohio, thus recording a spread from west to east.

Using the following pollution classification techniques each station was classified to a similar pollution level. (1) Goodnight and Whitley<sub>2</sub> (1961) used percentage of oligochaetes, (2) Wright (1930) used number of oligochaetes/meter<sup>2</sup>, and (3) Brinkhurst and Cook (1974) used species associations.

EFFECTS OF SEWAGE SLUDGE AND FERTILIZER ON THE PRODUCER TROPHIC LEVEL OF CONTRASTING OLD-FIELD COMMUNITIES.

Walter P. Carson and Gary W. Barrett, Department of Zoology and Institute of Environmental Sciences, Miami University, Oxford, Ohio 45056.

3:30

Effects of dried sludge (Milorganite) and fertilizer on the producer trophic level of contrasting old-field communities were investigated. Sludge (6-2-0; N-P-K) was applied monthly from May through September to 3 replicate 0.1 ha plots in a 1-year-old and a 5-year-old plant community. Fertilizer (6-2-0; N-P-K) was applied in a comparable manner to 3 replicate 0.1 ha plots in each community-type; 2 0.1 ha plots in each community served as controls. The monthly enrichment rate for either sludge or fertilizer was equivalent to 1792 kg/ha (1600 lbs/acre).

Net primary productivity (NPP) in the 1-year old-field was  $1991 \text{ g m}^{-2} \text{ yr}^{-1}$  for the sludge plots,  $1229 \text{ g m}^{-2} \text{ yr}^{-1}$  for the fertilizer plots, and  $1252 \text{ g m}^{-2} \text{ yr}^{-1}$  for the controls. NPP in the 5-year old-field community was  $1549 \text{ g m}^{-2} \text{ yr}^{-1}$  for the fertilizer plots,  $1166 \text{ g m}^{-2} \text{ yr}^{-1}$  for the sludge plots, and  $464 \text{ g m}^{-2} \text{ yr}^{-1}$  for the controls. No significant differences ( $P \leq 0.05$ ) in NPP were found for any sample date in the 5-year-old community whereas a significant increase ( $P < 0.05$ ) in productivity was observed in the 1-year old-field community in July for both sludge and fertilizer plots as compared to controls.

Control plots in the 1-year community exhibited significantly greater ( $P < 0.05$ ) values for both species richness and apportionment than nutrient-enriched plots. Competition for nutrients appeared to account for differences in community structure and function.

DETERMINATION OF THE PRIMARY DEGRADATION RATE OF THE HERBICIDE, TRIFLURALIN,  
BY NATURAL MICROBIAL COMMUNITIES

David J. Althaus and William S. Brewer

3:45

Department of Biological Sciences, Wright State University, Dayton, OH 45435

The determination of microbial degradation rates is an integral part of establishing the fate of xenobiotics in aquatic environments. Microbial degradation rates have been approximated with second order kinetic models. However, studies in this laboratory have indicated that the degradation of trifluralin can be approximated under first order conditions. Water samples obtained from Caesar's Lake were seeded with various concentrations of trifluralin (0-150 ug/l) and degradation rate constants were determined by following substrate disappearance and microbial growth. Kinetic constants of approximately  $2.2 \times 10^{-8}$  and  $1.85 \times 10^{-3}$  were determined for second order and first order kinetics, respectively. Continuous culture studies under similar conditions yielded kinetic constants of the same order of magnitude. Effects of environmental variables were evaluated through model discrimination.

## R. ECOLOGY

### SECOND AFTERNOON SESSION

201 KAUK HALL

DAVID W. WALLER, PRESIDING

COMPARISON OF RESOURCE DISPERSAL IN FOREST, OLD-FIELD AND ECOTONE HABITATS. Leslie W. Polgar and Gary W. Barrett, Department of Zoology and Institute of Environmental Sciences, Miami University, Oxford, Ohio 45056.

1:30

This study was conducted at the Miami University Ecology Research Center during the summer and early fall months of 1979 and 1980. A 1-ha forest and an adjacent 1-ha old-field community, along with their ecotone interface, served as the study site. Fleshy fruits, black raspberry (*Rubus occidentalis*), red mulberry (*Morus rubra*), blackberry (*Rubus frondosus*), and wild black cherry (*Prunus serotina*) were situated on log feeding sites (3/habitat). Logs (0.5-m length) were placed horizontally for 1979 trials and stood vertically for 1980 trials. Ten fruits were used at each feeding site; each trial lasted for five days. The sites were observed each morning, and the number of fruit remaining was recorded. No significant differences ( $p > 0.05$ ) were found among mean fruit dispersal rates in 1979. In 1980, however, forest resources were removed at a significantly higher rate ( $p \leq 0.05$ ) than old-field resources; ecotone rates were identical to those of the old-field. Removal rate differences appeared to be a function of both habitat structure and resource position. Interestingly, an adjacent wooded fence-row to the old-field community exhibited similar removal rate values to the forest community. The definition of ecotones (e.g., 2- vs. 3-dimensional entities) needs to be further investigated and clarified.

COMPARATIVE ACCURACY OF POPULATION ESTIMATORS FOR ENCLOSED SMALL MAMMAL POPULATIONS. William T. Peterjohn, Gary W. Barrett, and Michael P. Farrell.\* Institute of Environmental Sciences and Department of Zoology, Miami University, Oxford, Ohio 45056, and \*Division of Environmental Sciences, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830.

1:45

Population density estimates for populations of *Mus musculus* and *Microtus pennsylvanicus* of known size were obtained from three perturbation studies conducted on enclosed grassland and old-field communities at the Miami University Ecology Research Center. The comparative accuracy of Jolly's stochastic method, a modified Schnabel census, Overton's method, the calendar-of-catches procedure, and Hayne's removal method was evaluated.

Large overestimations were obtained from the Jolly procedure with mean percent errors ranging from 195.7 to 1245.0%. All other estimators produced much lower and similar mean percent errors which ranged from 12.2 to 46.4%. *Microtus* populations were underestimated by the Overton, calendar-of-catches, and Schnabel procedures in 92% of the cases. *Mus* populations were overestimated in 60% of the cases by the Schnabel and Overton methods but were underestimated by the calendar-of-catches method for all cases. Differences in catchability between species, the existence of trap-prone individuals within a species, and inherent biases of the estimators were thought to account for the inaccuracies observed.

BREEDING STRATEGIES IN CALIFORNIA GULLS: AGES OF MATED PAIRS AND THE RETURN RATE TO PREVIOUS YEAR'S NEST. Bruce H. Pugesek, Dept. of Biological Sciences, Bowling Green State University, Bowling Green, OH 43403, and Kenneth Diem, Dept. of Zoology and Physiology, The University of Wyoming, Laramie, WY 82071.

2:00

In a breeding population where birds range from 3 to 20 years of age, gulls selected mates of similar ages. Of 22 pairs in which the ages of both mates were known, 19 pairs consisted of mates that were within three years of age. Thirteen of those pairings were among mates of the same age. Age discrepancies among mated pairs occurred significantly more often in old pairs ( $\geq 11$  years old). When ages of mates differed, the female was usually older than the male. One explanation for the observation that gulls tend to select mates of the same age is that an age-related reproductive strategy exists, thus, gulls choose a mate of a similar age and strategy. With advancing age, mates of the same age appear to become increasingly difficult to obtain. Thirty-nine percent of the gulls sampled in 1979 returned to breed at the same nest site in 1980. Return rate to the old nest site was independent of the ages of the gulls, but was positively associated with 1979 reproductive success. An age-reproductive success interaction occurred in which old birds had the same return rate to 1979 nests regardless of previous breeding success at that site. Young birds, however, had a significantly lower rate of return to nest sites that failed in 1979. A significantly higher proportion of old gulls failed to return to nests where they had successfully raised young in 1979. This result suggests that old gulls may experience a higher yearly mortality rate.

A MODEL OF RANDOM TERRITORY SHAPE. David W. Waller, Department of Biological Sciences, Kent State University, Kent, Ohio 44242.

2:15

Available evidence is equivocal about whether or not territory shapes are circular. An approach for testing territory shape has been developed, based on a general model of area occupancy for conventionally territorial animals, such as birds. Occupancy is proposed to develop through two processes. The first is that new sites which an individual will ultimately claim are encountered in random excursions from already occupied area. The second is that areas are annexed by extension of convex polygonal bounds to enclose each newly claimed site. Under neutral conditions of unrestricted random movement of simple probabilistic pattern in an homogenous habitat, the model is related to the univariate "activity-radius" model which has been proposed to describe home-range use. The present model has been extended to predict territory shape, and thereby relates the univariate model to the bivariate model which has also been proposed to describe home-range use. Under neutral conditions, the present model predicts an "elliptical" shape, in which the ratio of maximum radius to a radius at  $90^\circ$  to it has an expected value of 1.5. Observed territorial dimensions may be compared to this to detect excessively circular or excessively "elliptical" shape. These deviations could be caused by peculiarities of the behavior of the species or the organization of the habitat. Data for such testing have been obtained only for the Tree Sparrow (Spizella arborea) and do not indicate significant deviation for that species.

FACTORS THAT MAY EFFECT THE DIVERSITY AND DISTRIBUTION OF SUMMERING WOODLAND BIRDS. Daniel R. Petit, Department of Biological Sciences, Kent State University, Kent, OH 44242.

2:30

Atmospheric moisture (humidity), foliage density, facing slope, soil moisture, and bird species diversity in each of twenty, .8 ha plots of mature deciduous woodland were recorded from June 15 to August 15, 1980. Woodland humidity was determined by the difference in simultaneous relative humidity readings from outside the woodland as compared to within the woodland. This allowed a quantitative designation of mesic vs. xeric woodlands. Of the four environmental factors tested, only atmospheric moisture and facing slope showed high correlation to bird species diversity. Foliage density (foliage height diversity), facing slope, and to a lesser extent soil moisture, were correlated to atmospheric moisture. These results indicate that as long as an "average" amount of understory foliage is present in a deciduous woodland, atmospheric moisture, rather than foliage density (MacArthur, 1961), becomes the limiting factor in bird species diversity. The atmospheric moisture is a result of foliage density and topographic setting (soil, slope, etc.). The avifauna populations had moderate correlation between foliage height diversity and nesting sites. Generally, species that nest above 6 m prefer more xeric woodlands with less understory foliage density. Nesters under 3 m followed a more densely vegetated understory. There was no correlation between any environmental factor and type of food, mainly because most woodland species are predominantly insectivorous.

HABITAT SUITABILITY AND PRODUCTIVITY IN THE DICKCISSEL, SPIZA AMERICANA. Steven J. Wegert, Department of Natural Resources, Fountain Square, Columbus, OH 43224 and Stephen D. Fretwell, Division of Biology, Kansas St Univ., Manhattan, KS. 66506.

2:45

Two habitats of markedly different character near Manhattan, Kansas-one an oldfield and the other a managed tall-grass prairie-were utilized to test the prediction that productivity of young (the number of nestlings x survival of the nest x nestling survival) was essentially the same for the two inhabiting populations of the territorial, polygonous Dickcissel. It was hypothesized that the oldfield habitat, having a higher density of males/acre(2.8) and more females/male(2.4) compared to the prairie habitat(0.2 males/acre and 1.3 females/male), would have both increased predation and a higher food density. Greater food density would increase the quality of food taken and lower the search time for each item taken, thereby allowing heavier young or more young per nest. The prairie habitat was predicted to have less food, fewer and lighter young/nest but less predation. Having heavier young or more young per nest would compensate for increased predation, thus balancing overall productivity.

Results showed that the oldfield habitat contained roughly four times the number of insects per square meter as the prairie habitat. The oldfield habitat contained 3.1 Dickcissel eggs/nest compared to 2.2 Dickcissel eggs/nest in the prairie habitat. Dickcissel young were found to be significantly heavier in the oldfield habitat than in the prairie habitat. Seventy percent of the oldfield nests were lost to predators (.081 predations/nest-day exposure) while only 48 percent of those in the prairie failed due to predation (.041 predations/nest day exposure).

ASPECTS OF FORAGING PATHWAY ORGANIZATION IN THE EASTERN CHIPMUNK, TAMIAS STRIATUS  
Greg Anthony, Dept. of Biological Sciences, Kent State University, Kent OH 44242

3:00

Foraging episodes were observed in a woodlot population of eastern chipmunks between September and November, 1980. The primary objective was to characterize the itinerary of a sedentary, central place forager; the secondary objective was to manipulate food patches of varying linear dispersions and monitor related behavior. A 7400 m<sup>2</sup> study site was sectioned into a ten x ten meter grid system. Entire movement episodes and associated behaviors were recorded. There was a tendency for turns to alternate while foraging. Crossovers per meter tended to be relatively low prior to food manipulation. An increase was observed when food patches were made available. This tendency to approach a "zig-zag" foraging pattern is optimal in that it minimizes circular geometries which lead to crossovers. The relatively low frequency of crossovers tends to minimize the suboptimal occurrence of traveling across a previously foraged area. The increase in crossovers when encountering a food patch may indicate a shifting to another foraging mode.

PARENTAL CARE IN A CAPTIVE GROUP OF GEOFFROY'S TAMARINS, SAGUINUS GEOFFROYI  
Carol A. Skinner, Dept. of Biological Sciences, Kent State University, Kent OH 44242

3:15

Geoffroy's tamarins, Saguinus geoffroyi, are small, New World primates which inhabit dense, low forest areas of Panama and northern Colombia. Patterns of parental care were observed in a captive family of these primates for six months following the birth of male twins on 26 May 1980. It was found that the male contributes a significantly greater amount of time in direct parental care than does the female. Behavioral dimorphisms in parental roles were also observed. Carrying, protecting and social feeding of the infants were almost exclusively performed by the male; whereas, the female, in addition to suckling the infants, gave them sanitation assistance. The male directed an average of 40% of his allogrooming efforts to the infants; the female directed about 70%. The performance of these behaviors changed over the course of development of the young, and an increase in social feeding by the female was observed around weaning. However, it seems that the responsibility for parental care falls mainly to the male. This pattern of parental care is consistent with observations of other Callitrichidae and with theories of monogamy and pair-bonding.

The cooperation of the Cleveland Metroparks Zoo in this study is gratefully acknowledged.



INCIDENCE OF CUTEREBRA IN WHITE-FOOTED MICE (PEROMYSCUS LEUCOPUS).-  
Carol Hopfer, Tedd Goundie, Gale Haigh, and Stephen Vessey. Department of  
Biological Sciences, Bowling Green State University, Bowling Green, Ohio 43403.

3:30

Mice live-trapped in a 2-ha. woodlot in Wood County, Ohio, were examined for the presence of larval bot flies (Cuterebra sp.). Of 548 mice captured during the summers of 1978 and 1979, 67 (12%) were infested. Approximately equal numbers of males and females were infested and only 1% of these were less than adult weight (19 g). There was no indication of localized outbreaks of parasitism within the woodlot. Infested mice remained in the trappable population significantly longer (5.1 weeks) than noninfested mice. Similar findings by others have been explained as reduced emigration of infested mice due to the immobilizing effects of the parasite. Our woodlot is surrounded by cultivated fields with the nearest suitable habitat 1.5 km distant, so emigration is an unlikely explanation for the difference. We suggest that longer duration in the trappable population is a cause rather than an effect of infestation. Older mice with established home ranges are more likely to be exposed to the parasite than are shorter-lived or transient ones.

HOST ACCEPTANCE AND SUITABILITY BY THE OVOVIVIPAROUS TACHINID PARASITOID BONNETIA COMTA (INSECTA: DIPTERA). W. L. Rubink, S. L. Clement, OARDC, Entomology Department, Wooster, OH 44691.

3:45

Correlations between adult and planidium preference for various hosts were examined in relation to characteristics of the host and its habits. B. comta adults, which show a larvipositional response to a kairomone in the feces of their major host, Agrotis ipsilon, (Lepidoptera: Noctuidae), show minor or negligible responses when exposed to feces of other known host species. This suggests a high degree of specificity for A. ipsilon. Parallel results were obtained when the free living, first instar larvae of B. comta were allowed to "select" suitable hosts. Host suitability, however, did not parallel host acceptability. Peridroma saucia (Lepidoptera: Noctuidae), although less acceptable, was equally suitable, and Pseudaletia unipuncta (Lepidoptera: Noctuidae), although highly unacceptable, was still suitable, albeit to a lesser degree. Results suggest that both chemical and physical properties of the outer integument affect host acceptability. The high degree of specificity of B. comta for A. ipsilon is hypothesized to be a function of the distinctive habits of the latter, which allow its location to be discovered by the parasite.

THE FUNCTIONAL RESPONSE OF ATHETA CORIARIA TO VARIOUS DENSITIES OF STELIDOTA GEMINATA EGGS IN RELATION TO TEMPERATURE AND LARVAL INSTAR.

4:00

K. V. Miller and R. N. Williams, Dept. of Entomology, Ohio Agricultural Research and Development Center, Wooster, OH 44691

Functional responses of the staphylinid, Atheta coriaria Kraatz, were examined in relation to the density of its prey, the eggs of Stelidota geminata (Say). Predators exposed to various densities of eggs on disks of germination paper (57 cm<sup>2</sup>) showed a functional response curve having a curvilinear rise to a plateau as prey densities increased from 2 to 64 eggs. Third instars consumed more eggs than adults or the other two instars. The number of eggs consumed by adults increased at all densities as temperature increased (15.6, 21.1, 26.7, and 32.7°C). Predictions using Holling's disk equation demonstrated an increase in the rate of successful search and a decrease in handling time as temperature increased. All predicted functional response curves (from Holling's disk equation) did not differ significantly from the observed functional response curves.

## R. ECOLOGY

THIRD AFTERNOON SESSION

4 KAUKU HALL

RALPH W. DEXTER, PRESIDING

1:30

A migration of E. corrupta into the N.W. Ohio area in 1977 brought about concern to create an insecticide that was both effective on the E. corrupta and environmentally safe. From literature in the field, the researcher found a suggested way to manufacture insecticide from natural pheromones. The researcher found the E. corrupta to have characteristics helpful in creation of such an insecticide. Through experimentation a procedure was developed to manufacture an effective substance using the E. corrupta which produced a high mortality rate in the E. corrupta species yet showed no negative environmental effects in controlled studies. The insecticide was produced by liquifying the E. corrupta in a blender with distilled water. This blend was then treated with an equal volume of ether. (The researcher found the toxic E. corrupta substance to be soluble in ether.) After a thorough mixing, the ether was extracted from the water. The remaining mixture was allowed to evaporate, leaving a residue. This residue was remixed with distilled water to form the insecticide. When applied to foliage the E. corrupta consumed, a mortality rate of better than 70% was recorded. To determine the environmental effects of the E. corrupta insecticide a controlled study was carried out using plattier and goldfish. A mortality rate of 0% was measured.

\*E. corrupta is used in the abstract to identify the Ephilachna corrupta or Mexican Bean Beetle

1:45

HOST PLANT EFFECT ON THE STALK BORER (PAPAPEMA NEBRIS (GN.)) AND ITS ASSOCIATED PARASITE COMPLEX. C. M. Felland, D. E. Simonet, and S. L. Clement. Department of Entomology, Ohio Agricultural Research and Development Center, Wooster, OH 44691.

Stalk borers (Papaipema nebris Gr.) (Lepidoptera:Noctuidae) were collected from weed and agronomic hosts during May-Sept., 1979-80. Infestation levels were recorded throughout the sampling period, and stalk borers were reared for parasite emergence. Infestations of stalk borer populations were highest on giant ragweed (Ambrosia trifida - 95.8%), common ragweed (Ambrosia artemisiifolia - 20.8%), and Canada thistle (Cirsium arvensis - 19%). Potatoes grown along weedy margins had higher infestations (8.9%) than potatoes grown along cultivated margins (1.2%). In corn, populations were localized with some weedy areas approaching 100% infestation, however, in most areas less than 10% of the stalks were infested. Populations in all hosts declined in mid-August as they left their host plants to pupate in the soil.

The rate of parasitism was highest in the preferred host, giant ragweed, and consisted primarily of an Ichneumonid (Lissonota brunnea?) and a Tachinid (Gymnocheta ruficornis?). In corn, parasitism was 18.2% and consisted primarily of a Tachinid complex. In other hosts, parasitism was quite low consisting primarily of a Eulophid (Sympiesis viridula (Thomson)) and a Braconid (Meteorus leviventris Wesm.).

In giant ragweed, interspecific competition between the 2 parasite species was reduced by differences in seasonal occurrence.

2:00

THE CAVERNICOLOUS FAUNA OF OHIO. PART II: INVERTEBRATES. H. H. Hobbs III and Michael F. Flynn. Department of Biology, Wittenberg University, Springfield, Ohio 45501.

Currently the fauna of the caves and rock shelters of Ohio is represented by 104 species (57 families); 66 (63.5 o/o) are invertebrates. Most of these cavernicoles have been collected from caves developed in Palaeozoic, dolomitic, limestones of the central and western parts of the state, however, a number of animals have been collected from the sandstone "caves" and shelters of eastern Ohio. Only four species are highly specialized, obligate cave-dwellers; the remaining demonstrate little or no apparent adaptations for spelean existence.

A new species of pseudoscorpion of the genus Apochthonius (Chthoniidae) was found in one of the 69 caves (17 counties) visited. Only two caves are type-localities for other Ohio invertebrates and the majority of specimens represent new locality records (county and/or state). Current distribution of Ohio's terrestrial and aquatic invertebrate cavernicoles is discussed with particular reference to pre- and post-glacial geology. This research is supported in part by the Ohio Biological Survey and the Ohio Division of Natural Resources (Division of Natural Areas and Preserves).

2:15

Marine fiddler crabs (Uca pugnax) were excluded from an area of beach using 1m<sup>2</sup> galvanized cages. Densities of major meiofauna taxa were recorded prior to exclusion and 21 days post-exclusion. From the same area, meiofauna samples were taken successively at low-water level, high-water, and 3 hours after high-water, to examine if the time of sampling, with respect to a tidal cycle, presents a possible bias in the biological interpretation of this habitat.

Sediments remained constant and well-sorted during both sampling periods with the mean grain size 225  $\mu$ m. In the surface centimeter of sediment, there were significant differences in the density of total meiofauna and Turbellarians, between caged and non-caged areas. The most abundant groups (Nematodes and Ciliates) showed no significant differences. At 1-2 cm. depth, the Nematodes, Gnathostomulida, and Ciliates, showed significant changes in density, while changes in Turbellarians and total meiofauna were not significant. During the 3 segments of the tidal-cycle sampling series, total meiofauna density changed significantly as did the Turbellarians, Halacarids, and Ciliates. Nematodes, Gnathostomulids and Copepods showed no significant changes over the same series.

This study was conducted at Duke University Marine Laboratory in Beaufort, North Carolina.

COMPARISON OF FILTRATION RATES AS A FUNCTION OF SUSPENDED PARTICLE CONCENTRATION IN THE FRESHWATER SPHAERIID CLAMS, MUSCULIUM PARTUMEIUM (SAY) AND MUSCULIUM LACUSTRE (MULLER). Denis G. Conover, R. Jennifer Detrick, Jeffrey P. Alexander and Albert J. Burky. Department of Biology, University of Dayton, Dayton, OH 45469

2:30

Filtration rates (FR) were measured using 2.02  $\mu$  diameter PVT beads (polyvinyl-toluene beads, Burky & Benjamin, 1979. Comp.Biochem.Physiol., 63A:483-484). For M.partumeium and M.lacustre FRs were measured under conditions of O<sub>2</sub> saturation at 20°C. Experiments were run over periods of two weeks in July and 10 weeks in May-July at seven (Range:1.38-88 ppm) and five (Range:2.75-44 ppm) PVT conc for the two species respectively. FRs were also determined on M.partumeium for low O<sub>2</sub> (<2.5 ppm) at 20°C during two weeks in August at five PVT conc (Range:2.75-44 ppm). FRs<sup>2</sup> (ml H<sub>2</sub>O clam<sup>-1</sup>hr<sup>-1</sup>) were calculated for a one mg ash-free dry weight standard clam at each PVT conc using the size rate equation. Aerobically for M.partumeium the FR of a standard clam is inversely related to PVT conc according to the approximation FR=0.5+5.0 (0.9)<sup>conc</sup>. Thus, FRs at 1.0 and >40 ppm (above 40 ppm FR is essentially constant) would be 5.0 and ~ 0.5 ml H<sub>2</sub>O clam<sup>-1</sup>hr<sup>-1</sup> respectively. Aerobically for standard size M.lacustre there is no apparent change in FR with change in PVT conc where mean FR=1.51, S.E.=0.37. For standard size M.partumeium at low O<sub>2</sub>, FR is consistently low at all PVT conc where mean FR=0.17, S.E.=0.06. Aerobic data suggests that M.partumeium can adjust FR and thus food intake according to availability while M.lacustre cannot. FRs at low O<sub>2</sub> for M.partumeium imply that O<sub>2</sub> availability affects food intake and probably reflects actual habitat conditions for this species in July-August. Supported by NSF-URP Grant Number SPI-7926926.

PHOTOPERIOD AS A CUE FOR GROWTH IN THE FRESHWATER SPHAERIID CLAM, MUSCULIUM PARTUMEIUM (SAY). Denis G. Conover and Albert J. Burky, Department of Biology, University of Dayton, Dayton, Ohio 45469.

2:45

Normally, spring-born M. partumeium remain dormant until late August in permanent ponds. At this time they initiate rapid growth. One of us (A.J.B.) has proposed that changing photoperiod (decreasing daylength) may function as the appropriate growth cue in late summer. On July 24, 1980 seventy-two, newborn clams were collected, shell length measured to the nearest 0.1 mm (greatest anterior-posterior dimension) and six placed in each of 12 four inch finger bowls with natural substrate and water. Half of the cultures were covered with a blackout unit late each afternoon and uncovered about nine the following morning to provide short days (L:D ~ 9:15). The other cultures were left exposed to continuous laboratory lights near large windows. After 64 days, growth was apparent in 31 out of 36 (86%) of the short day clams (mean shell length = 1.29 mm on day zero, mean = 1.43 mm on day 64: significantly different at the 0.001 probability level) with most of the observed growth having occurred during the first 30 days. In the long day group, however, only eight out of 36 (22%) clams showed increased size after 64 days (mean shell length = 1.34 mm on day zero, mean = 1.35 mm on day 64). The slight increase for the long day clams can be attributed to measuring error. Although these results are not conclusive they suggest that decreasing daylength is a cue for initiating growth in M. partumeium in late August. More experiments are needed on the influence of photoperiod on all stages of life-history in relation to season in this organism.

EARLY DESCRIPTION OF THE NATURAL ENVIRONMENT OF OHIO (1788): SCIENCE OR PROPAGANDA? Ralph W. Dexter, Department of Biological Sciences, Kent State University, Kent, Ohio 44242

3:00

In 1787 Dr. Manasseh Cutler of Massachusetts published a map and an account of the natural environment of the Ohio Valley for use by the Ohio Land Co. In 1788 the text was translated into French with some additions and modifications for use by the Scioto Land Co. to induce Frenchmen to establish a colony at Gallipolis on the Ohio River. (This edition was in turn translated back into English in 1888 by J.H. James entitled "Ohio in 1788. A description of the soil, productions etc. of that portion of the U.S. situated between Pennsylvania, the Rivers Ohio and Scioto, and Lake Erie.") The Ohio and Scioto Valleys were described as a "Garden of the Universe" where crops could easily be raised and shipped to markets in the east. Nature of the climate, soils, prospective crops, and the condition of rivers is exaggerated and sometimes incorrect and misleading. Some 500 emigrants from France attempted a settlement at Gallipolis in 1790, but most of them soon left with bitter disappointment. Both English and French editions of the booklet were propaganda for land sales and not a scientific account of the Ohio environment in pioneer days.

#### ALTERNATE METHODS OF SAMPLING FOR GIARDIA SPP. CYSTS IN NATURAL WATERS

Kevin T. Rookstool, William S. Brewer and P.J. Woodford

Department of Biological Sciences, Wright State University, Dayton, OH 45435

3:15

Ion exchange resins as well as diatomaceous earth was examined as potential filter media for the detection of Giardia spp. cysts in natural waters. Both anion and cation exchange resins exhibited the capacity to retain cysts which was pH dependent. Filter characteristics of diatomaceous earth allowed for up to 95% retention of known quantities of cysts. These results exceed retention characteristics of current filtering techniques.

ROOT REGENERATION AND SURVIVAL OF PLANTED AUSTRIAN PINE (PINUS NIGRA ARNOLD) AND ARBORVITAE (THUJA OCCIDENTALIS L.) SEEDLINGS AS INFLUENCED BY FALL AND SPRING LIFTING DATES. Larson, M. M., Dept. of Forestry, OARDC, Wooster, OH 44691.

3:30

Austrian pine and arborvitae nursery-grown seedlings were lifted and outplanted in October, November and April. Roots of half the trees were dipped in starch-polyacrylonitrile gel before planting. Trees were then outplanted at two locations, and additional trees were grown in a growth chamber for 4 weeks to measure root regeneration.

First-year survival of Austrian pine was 15% for October, 60% for November and 91% for April planted trees. Percentage of trees in the growth chamber with root regeneration was 12% for October, 29% for November and 60% for April planted trees. On June 5, mean needle water deficits (NWD) of outplanted trees varied from 33% for October to 23% for April trees. Individually, few trees with NWD greater than 25% survived, and none survived when NWD exceeded 35%. These results indicate that the general failure of fall planted Austrian pine is due to poor root regeneration, followed by excessive water stress.

First-year survival of arborvitae was very good (85% or more) for all seasons, although total height of all fall planted trees averaged 22% less than that of April trees. Root regeneration of fall trees averaged 69% compared to 100% for April trees. Root gel treatment had no important effects on either Austrian pine or arborvitae trees in this study.

A MARKOVIAN APPROACH TO MODELING A SECONDARY SUCCESSION. Patrick S. Bourgeron,  
Department of Biology, Sherbrooke University, Sherbrooke, P.Q., Canada, J1K 2R1.

3:45

Markov theory was used in order to model a secondary succession in the coastal plain of South Carolina. Three matrices of transition, based on increasingly complex hypotheses, were built in order to improve the quality of simulations. The first conclusion was that the studied succession is not an independent process in character, i.e. is Markovian by implication. Realistic results were obtained from the model:  $dN_j/dr = -d_j n_j +$

$$\sum_{i=1}^s d_i N_{ipij} \quad (d_i: \text{death rate of species } i; \quad p_{ij} = \frac{n_{ij}}{\sum_{j=1}^s n_{ij}}; \quad n_{ij}: \text{number of offsprings of species } j \text{ beneath the crowns of canopy trees of species } i).$$

The corresponding matrix of transition represents, in probabilistic terms, a "tolerance model" (sensu Connell & Slatyer, 1977). The first four stages of the theoretical succession are in agreement with the actual data set, yet the predicted climax (i.e. the stationary distribution of Markovian chain) is never observed in the study area. Two alternative hypotheses, one based on human activities and the other on species properties (hence on the characteristics of the matrix of transition), were generated for explaining this discrepancy, yet they cannot be tested with the actual data set. Finally, the effects of some logging strategies on community structure, which is the product of the dynamics of succession, have been considered.

DO RED-WINGED BLACKBIRDS MAINTAIN THEIR SEX DRIVE AFTER CHEMOSTERILIZATION? Jean de Traversay, Patrick S. Bourgeron and André Cyr, Département de Biologie, Sherbrooke University, Sherbrooke, P.Q., Canada, J1K 2R1.

4:00

This study was aimed at determining the effects of temporary chemosterilization of male Red-winged Blackbirds (*Agelaius phoeniceus*) on their libido. Behavior of 30 individuals (20 Controls - 10 Treated) was recorded in upland habitat through direct observations following a standard ethogram.

Ordination techniques (Principal Component Analysis and Reciprocal Analysis) exhibited clearly the major differences between the two groups of individuals, yet no pattern of behavioral trend emerged readily. Changes in behavioral sequences were then examined using a transitional analysis. The results suggests that chemosterilization induces minor changes in behavioral trends.

## S. INFORMATION & LIBRARY SCIENCES

FIRST MORNING SESSION

ANDREWS LIBRARY

R. M. WATTERSON, PRESIDING

USER SURVEY OF THE MAP COLLECTION AT THE UNIVERSITY OF TOLEDO, G. Robert McLean,  
William S. Carlson Library, University of Toledo, 2801 West Bancroft St.,  
Toledo, Ohio, 436006

9:15

A study was conducted in the winter quarter of 1980 at the William S. Carlson Library of the University of Toledo with the specific purpose of gaining knowledge of the cartographic needs of users of the map collection. The study yielded results in terms of types of users and the kinds of materials sought. Statistical information obtained from interviews disclosed the academic and departmental levels of users, their purposes and the types, subjects, forms and geographical areas requested. This information is expected to assist in the upgrading of the map collection itself and of the service performed to its users.

A LIBRARY IS INSTRUMENTAL IN KEEPING THE PUBLIC INFORMED ON NUCLEAR WASTE. Beverly A. Rawles, Office of Nuclear Waste Isolation, Battelle, 505 King Avenue, Columbus, Ohio 43201.

9:30

A small, specialized library has been developed at the Office of Nuclear Waste Isolation (ONWI), under contract to the U.S. Department of Energy, to make information on nuclear waste available to the public.

The ONWI Library was established in May 1978, as a study center open to the public and as a repository of reports for distribution. The Library strives to consolidate, into one place, current and relevant information on nuclear waste isolation.

The ONWI Library publishes guides to the literature and technical reports on nuclear waste isolation which result from scientific and technical investigations conducted under the National Waste Terminal Storage Program of the DOE. In its 2-1/2 year lifetime, it has distributed 100,000 copies of reports and responded to nearly 15,000 specific requests for information in its efforts to inform the public about this important problem facing the nation.

ESTABLISHING GUIDELINES FOR WEEDING HEALTH SCIENCES COLLECTIONS. Charles A. Isetts, 6483 MonaLisa Court, Cincinnati, Ohio 45239

10:00

Health Sciences Libraries normally lack space and must regularly weed their collections. However, there is always the fear that something historically valuable will be discarded. To lessen this problem, there are some basic guidelines a librarian can follow. First of all, there are no absolute rules; since today's garbage is so often tomorrow's treasure. However, by establishing a set of preconceived guidelines a librarian can make valid judgments as to what to keep and what to sell. Included in such guidelines would be categories of time, location, subject matter, author, and historical lists. For example, a librarian could choose to retain items published before 1850, or material relating to the Toledo area. Other areas for retention could be subjects such as polio or diabetes, all faculty publications, or all items found in a standard historical bibliography. Whatever the categories chosen, a preconceived plan is necessary to keep weeding from becoming the mere elimination of the old.

USE OF AN ON-LINE CATALOG IN RELATION TO THE PROXIMITY OF TERMINALS TO A CARD CATALOG. Robert W. Williams, Health Sciences Library, The Ohio State University, Columbus, Ohio 43210.

10:15

More than 500,000 searches, performed on both public and non-public terminals at The Ohio State University Health Sciences Library using the OSU Libraries on-line catalog (LCS) were statistically analyzed to discover the relationship between terminal proximity to a card catalog and the way LCS is utilized. Raw data was collected automatically over a three year period by the LCS computer according to the type of search attempted; author, title, combination of author and title, call number, shelf position, and complete bibliographic record. A computer program was utilized to create dependent variables from this raw data, which express user preference for type of searching. Among these variables are the ratios of bibliographic to inventory searches, known item to subject searches, and searches for complete bibliographic information to total searches. The moving of the card catalog from one area, close to a group of terminals, to another area in close proximity to a second group of terminals served as the independent variable. User preference in relation to the different capabilities of the card catalog and the on-line system are discussed.

# S. INFORMATION & LIBRARY SCIENCES.

FIRST AFTERNOON SESSION

ANDREWS LIBRARY

R. M. WATTERSON, PRESIDING

1:30 BUSINESS MEETING

2:00 PLANNING PERSONNEL PATTERNS DURING MAJOR CHANGES IN COLLECTION DEVELOPMENT BUDGETS.

K. Penny Young, Assistant Director, and Doris Haag, Head, Division of Bibliographic Access and Processing, Medical Center Libraries, University of Cincinnati.

The University of Cincinnati Medical Center Libraries Benefited from a Major Increase (AP. 100%) in collection development budgets during the 1979-81 biennium. The supportive services department, which includes acquisitions, cataloging, serials, and other technical services, received limited funds for staff increases in order to deal with the increased volumes of work which resulted (AP. 60% in serials, 30% in monographs, and 100% in non-print media). In order to make the most effective use of personnel, a method of quantifying and projecting work efforts was used in each year of the biennium. This method has relevance for other situations in which increases or decreases in collection development expenditures are planned.

Most major changes were made at the beginning of the first year of the biennium (summer, 1979). Previous personnel studies had provided baseline data for existing staff on the time allocated to various specific tasks. Projected collection development increases were allocated among different types of materials and converted into projected quantities of those materials. From these figures, increases in the various tasks were estimated. These tasks were then divided among staff into distinct positions. Personnel costs of the department were completely reviewed, with conversion of student assistant monies into permanent staff positions.

## INTERLIBRARY LOANS: A COST RECOVERY METHODOLOGY

Ava Krinick Fried, Head of Materials Access Division, Medical Center Libraries, University of Cincinnati.

2:30

The University of Cincinnati Medical Center Libraries is an active participant in the document delivery services of the Kentucky-Ohio-Michigan Regional Medical Library Network. We serve as the resource library for health-related individuals and institutions in the southwestern Ohio and northern Kentucky area.

The demand for our interlibrary loan services has been increasing at the rate of 25% per year. This high investment of staff time led the interlibrary loan department to conduct a study to identify the actual time and costs involved in providing interlibrary loan service to primary patrons and service area institutions. The major tasks which contribute to borrowing, lending, and referral transactions were identified, logged, and timed. Direct and indirect costs were then computed for the completion of each of the tasks in the major functional areas.

The study revealed that providing interlibrary loan service is a high cost operation. Based on these results, it was determined that a pricing structure for interlibrary loans for service area institutions be established to recover the direct costs identified in lending and referral transactions.

## POSTER SESSIONS

LOBBY OF FREEDLANDER THEATRE

### ARGINYL RESIDUES AT RECOGNITION SITES IN MEMBRANE ANION

TRANSPORT. C. L. Borders, Jr., College of Wooster, Wooster, Ohio 44691 and J. O. Wieth and P. J. Bjerrum, University of Copenhagen, Copenhagen Denmark.

Board A

@ 9:00

It has been suggested that an arginyl residue may be essential for normal function of the specific anion transport system which mediates the physiologically important chloride-bicarbonate exchange across the erythrocyte membrane, but previous attempts to modify transport function irreversibly with arginine reagents have been unsuccessful. We now report that anion transport in resealed human erythrocyte ghosts is inhibited by phenylglyoxal, a reagent which is highly specific for the modification of arginyl residues in proteins. Surprisingly, phenylglyoxal exhibits two modes of inhibition. Anion transport is inhibited in a fully reversible manner at low temperatures, while irreversible binding of phenylglyoxal and irreversible inhibition of transport occur only when membranes are exposed to phenylglyoxal in an alkaline extracellular medium at higher temperatures. Using  $^{14}\text{C}$ -phenylglyoxal, it was found that irreversible inactivation is due to the modification of  $\text{ca. } 2 \times 10^6$  arginines per ghost cell. Most of the  $^{14}\text{C}$  is incorporated into the band 3 protein known to be involved in anion transport. Thus, inactivation correlates with the modification of ca. 2 arginyl residues per band 3 molecule.

CORRELATIONS BETWEEN LEFT VENTRICULAR EJECTION TIMES DETERMINED SIMULTANEOUSLY FROM THE CAROTID PULSE CONTOUR AND FROM THE IMPEDANCE CARDIOGRAM. M.A.B. Frey and B.M. Doerr, Department of Physiology, Wright State University, Dayton, Ohio 45435.

Board B

@ 9:00

Systolic time interval (STI) analysis is a widely-used noninvasive technique for clinical and research evaluation of cardiac function. This technique requires simultaneous recording of an ECG, phonocardiogram, and carotid pulse contour (CPC). The CPC, from which ejection time (ET) is determined (upstroke to dicrotid), frequently is awkward to monitor. Impedance cardiography is a relatively recent advance in the noninvasive determination of cardiac function and stroke volume which may be used simultaneously with STI's. ET is also determined from the impedance cardiogram (IC). If these two determinations of ET were known to be well correlated, the CPC recording could be eliminated, ET determined from the IC, and pre-ejection period (PEP) calculated as "PEP = electromechanical systole - ET(IC)." To examine this correlation, we recorded simultaneous CPC and IC in 17 male subjects, 39-63 years of age. Data were recorded at a paper speed of 100 mm/sec for 15 sec as subjects sat at rest on a bicycle ergometer, at submaximal heart rate levels immediately after progressive 3.5-min exercise bouts separated by 2-min rest periods, and immediately after the exercise bout when subjects attained 85% of their age-predicted maximal heart rate. Correlations between the two ET values for the 17 subjects were as follows: (1) rest,  $r=0.99$ , (2) submaximal exercise,  $r=0.97$ , and (3) 85% max,  $r=0.99$ . These results indicate the two techniques provide similar values for ET. Therefore, ET(IC) may be used in STI analysis, and specifically the calculation of PEP. Supported in part by American Heart Association, Miami Valley Chapter.

SCANNING ELECTRON MICROSCOPY OF PERIOSTEAL BONE FORMATION IN FLUORIDE-TREATED RATS. Larry J. Ream, Paula B. Pendergrass and Jane N. Scott, Department of Anatomy, Wright State University, School of Medicine, Dayton, Ohio 45435.

Board C

@ 9:00

Anorganic preparations of the femoral diaphyses of young rats given 150 ppm fluoride in the drinking water for 10 weeks are examined by scanning electron microscopy and compared to similar preparations from untreated rats. In femoral bone of untreated animals, periosteal apposition areas show incompletely mineralized collagen fibers. Ordered mineral deposits are uniform in size, closely packed, and globiform in shape. Osteocyte lacunae are shallow, regular in outline, and lined by smooth-surfaced walls. In fluoride-treated animals apposition areas appear frayed, consisting of bunches of poorly defined needles; mineralized segments vary in size with wide spaces in between. The uneven surface texture reflects an irregular orientation of the collagen fiber bundles. There is an increase in osteocyte lacunae which are buried at various depths on the periosteal surface. The lacunar walls are irregular with mineralized segments running in all directions. Our observations indicate that the ingestion of fluoride for 10 weeks in the rat results in an increase in periosteal matrix and bone formation presumably as a result of increased osteoblastic activity. In addition, there is an inhibition of the process of mineralization at the periosteum due to a delay in the initiation of mineralization in osteoid and young bone. Further, the irregular orientation of collagen fibers and numerous incompletely buried osteocyte lacunae are features of immature, woven bone.



Board D SCANNING ELECTRON MICROSCOPY OF CORPUS LUTEUM FORMATION IN THE GOLDEN HAMSTER.  
Paula B. Pendergrass, Department of Anatomy, Wright State University, School of  
Medicine, Dayton, Ohio 45435.  
@ 9:00

SEM observations of corpus luteum formation in the golden hamster, *Mesocricetus auratus*, reveal considerable cellular migration occurring in both the newly forming luteal mass and the remaining surface epithelium. During the first 24 h of the 4-day cycle, cells in the luteal mass become aligned into cords which migrate centrally to obliterate the crater-like rupture. Individual cords lose their distinct surface profiles as the luteal mass forms a mushroom-like cap, the edges of which overhang surface epithelial cells (SEC) bordering the rupture site. The luteal mass continues to remodel as the edges slowly recede during the next 3 days of the cycle and the follicle assumes a more spherical shape with a slightly sunken apex as regression begins.

Covering of the rupture site by the SEC is a slow process which occurs by 2 processes. Most of the mass is gradually covered by finger-like columns of SEC which migrate from the collar of cells surrounding the luteal mass to gradually isolate, then cover, small spherical or oval regions of the slightly sunken mass. In addition, individual SEC migrate out of the collar and move up onto the mass. The entire covering process appears to be random and poorly coordinated until very late in the 4-day cycle. This is attributed to changing surface properties observed on the luteal mass.

Board A AN EVALUATION OF NON-POINT POLLUTION POTENTIAL FROM PASTURING LIVESTOCK ON HILL-LAND.  
R.W. Van Keuren, L.B. Owens, and W.M. Edwards, Ohio Agr. Res. and Dev. Center,  
Wooster, OH 44691, and USDA-SEA-AR, Coshocton, OH 43812.  
@ 10:00

A beef cattle-pasturing system involving rotationally grazed summer pastures with winter-feeding on one pasture was studied on sloping upland watersheds in Ohio to determine the effect on water movement and chemical quality. Pasturing cattle during the summer on moderately fertilized fields resulted in very limited surface runoff. The concentration of chemicals in runoff from the summer pastures increased relative to that of incoming precipitation, but not enough to significantly impair water quality. No measurable sediment was lost, allowing no chemical movement via that pathway. However, runoff from the winter-feeding area was markedly increased compared with usage as summer pasture or hay meadow, with some surface erosion and more chemical movement. Considerably more chemicals moved in subsurface than in surface flow from the summer pastures while amounts of chemicals transported from the winter-feeding pastures were equally as great in surface and subsurface flow. Surface and subsurface water from summer pasture was well below U.S. Public Health Service standards for acceptable water quality. The quality of the subsurface water from the winter-feeding pasture also met the USPHS standards, but surface runoff sometimes exceeded these standards. Watershed surface management was a key factor in determining not only flow route of water but also water quality.

Board B EFFECT OF ETHYLENE ON PEA EPICOTYL TISSUE II. THE RESPONSE OF PEA EPICOTYL TISSUE  
TO AUXIN AND HYDROGEN IONS AFTER ETHYLENE TREATMENT. Grant M. Barkley and Ann Di-  
Francesco, Department of Biological Sciences, Kent State University, 4314 Mahoning  
Avenue, N.W., Warren, Ohio 44483  
@ 10:00

Application of ethylene gas to four or five-day-old seedlings of etiolated pea results in radial expansion of subapical internode tissue. Induction of the swelling response is concentration dependent and may take between 15 to 90 minutes. Changes in both the radial dimension and length may be assayed using the following formula;

$$\frac{W_f/L_f - W_i/L_i}{W_i/L_i} \times 100$$

where  $W_i$  and  $L_i$  are the initial weights and lengths of a marked subapical zone and the  $W_f$  and  $L_f$  are the final weights and lengths of similarly marked zones after ethylene treatment [Physiol. Plant, 15: 115-121]. Using this formula percent swelling may be calculated

with typical values reaching 50 percent within 20 hours of ethylene treatment. Subapical segments, excised at various times after exposure to ethylene show decreasing sensitivity to both auxin (indole-3-acetic acid) and hydrogen ions. No response to auxin or lowered pH is obtained by subapical segments which has achieved 20 percent or greater swelling index.

Board C SPERMATOGENESIS IN AGING OPOSSUM TESTES. Jane N. Scott, Department of Anatomy, Wright State University, School of Medicine, Dayton, Ohio 45435.

@ 10:00

To determine effects of aging on the testes of the opossum (Didelphis virginiana), males raised in captivity were sacrificed at 5, 6, 9, 10 and 20 months of age. The testes were removed, fixed in Helly's fluid, processed for routine paraffin sectioning, and stained with Mallory's aniline blue or the nucleal-PAS-orange G procedure.

At 5 months of age, most seminiferous tubules had open lumina, displayed typical Sertoli cells, and were lined with one layer of spermatogonial cells. Degenerating cells characteristic of forming tubules were present. In interstitial tissue, cells had morphologically differentiated into Leydig cells. By 6 months of age, seminiferous tubules contained numerous spermatogonial cells. Occasionally spermatogenesis had progressed to the spermatid stage as indicated by acrosomal formation and condensed nuclei. No spermatids with inverted V-shaped nuclei were evident. Testes of 9 month opossums were typical of young adult animals. All stages of spermatogenesis were present with fully formed spermatids in many tubules; interstitial tissue contained numerous well-developed Leydig cells. Although normal spermatogenesis was prevalent in testes of 10 and 20 month animals, degenerating cells were more evident than in 9 month testes. At 20 months of age there appeared to be a striking decrease in the number of Leydig cells. These observations indicate that in opossums raised in captivity formation of Leydig cells preceded the onset of spermatogenesis, and sperm formation was fully developed by 9 months. In older animals there was an apparent decrease in the number of Leydig cells in the interstitial tissue.

Board D POPULATION BIOLOGY OF TWO SPECIES OF SPINITECTUS (SPIRURIDA: NEMATODA) IN FISHES OF WESTERN LAKE ERIE. Reid Jilek and John L. Crites. The Center for Lake Erie Research and the Department of Zoology, The Ohio State University, Columbus 43210

@ 10:00

Spinitectus carolini Holl, 1928 and Spinitectus gracilis Ward and Magath, 1916 are two of the most common parasites of fishes in eastern and central North America. A survey of 1174 Lake Erie fish, comprising 11 species, has shown a substantial

change in prevalence of these two nematodes in comparison with earlier studies. These changes are: the first indication of dual parasitism by both species; an overall decrease in the prevalence of S. carolini; new host records for S. carolini and S. gracilis. Infection rates were highest for rock bass (88%), small mouth bass (55%) pumpkinseed sunfish (56%) and bluegills (50%). The percent infection of S. carolini and S. gracilis increased from May through September, the higher infection rates occurred in younger fish. The mean worm burdens increased from May through August and then declined. S. carolini infections were usually greater in prevalence and mean worm burden than those of S. gracilis. Female nematodes of both species outnumbered males, 2:1, throughout the infection period. Recruitment of 3rd stage larvae was greatest from June through August when the intermediate hosts were available. Analysis of the weight/length/age relationships of rock bass infected with Spinitectus indicated increased growth for infected fish the first 2 years followed by a loss in weight.

Board A PHOTOSYNTHESIS, PHOTORESPIRATION, AND CO<sub>2</sub> GROWTH ENHANCEMENT IN FIVE DUCKWEED SPECIES. K. V. Loats, D. Smithwood, and \*R. D. Noble. Department of Biology, Denison University, Granville, Ohio 43023 and \*Department of Biological Sciences, Bowling Green University, Bowling Green, Ohio 43403.

@ 1:30

To establish photosynthetic and growth rates under control conditions net photosynthesis, photorespiration, dark respiration, and fronds counts were determined in Lemna minor, L. perpusilla, L. gibba, L. valdiviana, and Spirodela oligorhiza. Photosynthesis, photorespiration, and dark respiration were determined using infrared gas analysis in a closed system at 300 ppm CO<sub>2</sub> and are expressed on a per area, per fresh weight, per dry weight, and per frond basis. The photosynthetic rates are high or similar relative to other plants depending upon the parameter of expression. Photorespiration rates characteristic of C-3 plants were detected in all species studied.

Growth parameters under long-term CO<sub>2</sub> enhancement conditions were investigated and the data indicate species differences relative to growth promotion or inhibition.

ACTIVITY AND METABOLISM OF 9 MASKED CYTOKININS IN DEVELOPMENT

David F. Blaydes, W. J. Pietraface and Wendy Wooddell

Board B Department of Biology, West Virginia University, Morgantown, WV 26506  
and Oneonta State University, Oneonta, NY 13820

@ 1:30

Masking of the 9 position of the purine ring of cytokinins (the point of attachment of PRPP in the salvage pathway of nucleotide synthesis) thus preventing nucleotide synthesis, offers another strategy for finding the active form(s) of cytokinin. Masking, coupled with  $^{14}\text{C}$  in the methylene carbon of 9 methyl N6 Benzyladenine (N6-BA) led us to the conclusion that little if any nucleotide is formed from cytokinin by "greening" cucumber cotyledons (Gasque and Blaydes, Plant Phys. Vol. 63, 1978). Pietraface and Blaydes (Plant Phys. Vol. 64, 1979) showed that in germinating lettuce achenes, nucleotide and later nucleoside are formed and that far-red light and coumarin prevent formation of the nucleoside of N6-Benzyladenine. Here we will report further on the form(s) of cytokinin in these systems and on the activity and metabolism of 9 masked N6-BA by the wheat-leaf senescence system.

THE EFFECT OF CHOLECALCIFEROL (VITAMIN  $\text{D}_3$ ), A POSSIBLE RODENTICIDE, ON LABORATORY MICE (MUS MUSCULUS).

Board C Hailu Kassa, Center for Environmental Research and Services, Bowling Green State University, Bowling Green, Ohio 43403.

@ 1:30

The effectiveness of vitamin  $\text{D}_3$  (cholecalciferol) as a possible rodenticide was evaluated using the house mouse (Mus musculus). Determination of bait efficacy,  $\text{LD}_{50}$ , paired bait preferences and levels of serum calcium in poisoned mice were undertaken.

Three formulations (0.1%, 0.075%, and 0.050%) of the six used produced 100% mortality. The  $\text{LD}_{50}$  as determined by stomach intubation was 42.50 mg/kg. Baits containing 0.1% and 0.075% vitamin  $\text{D}_3$  were as well accepted as the untreated baits ( $P < 0.05$ ). The level of serum calcium was elevated significantly in mice treated with 0.1%, 0.075%, and 0.050% vitamin  $\text{D}_3$ .

Vitamin  $\text{D}_3$ , if ingested in excess of requirements for maintenance of calcium homeostasis, can function as an acute rodenticide. Baits are palatable, and those containing as low as 0.050% vitamin  $\text{D}_3$  are lethal to house mice.

DIFFERENTIATION AND IDENTIFICATION OF THE NORTH AMERICAN SPECIES OF SPINITECTUS FOURMENT, 1883, BY SCANNING ELECTRON MICROSCOPY.

Board D Reid Jilek and John L. Crites, Division of Biomedical Engineering, University of Virginia, Charlottesville, Virginia and the Department of Zoology, The Ohio State University, Columbus, Ohio.

@ 1:30

The genus Spinitectus Fourment, 1883, is comprised of 43 species. However, the North American representatives of the genus number but four: S. beaveri Overstreet, 1970; S. carolini Holl, 1928; S. gracilis Ward and Magath, 1916; S. micracanthus Christian, 1972. The criteria used for distinguishing and identifying the species of Spinitectus vary greatly depending on the authors. The present study indicates that differentiation and identification can be facilitated through the use of scanning electron microscopy. Previously undescribed sensory structures, deirids, were observed on each of the species. The deirids varied in morphology and location on the worm. En face views have revealed anatomical differences in the papillae, amphids, pseudolips, and oral opening, among the four species examined. Lastly, and possibly the most taxonomically important structures, are the spines. There is considerable variation among the North American species in spine number, spine morphology, spine length, and spine pattern. This spine variability, however, was nonexistent within a given species, thus no intraspecific variability. Scanning electron microscopy functions as a useful tool in differentiating species of Spinitectus and may possibly aid in the reduction of some species to synonymy. Supported in part by NSF Grant 76-01414